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# FRDA REPORT 121

# INCREASING THE UTILIZATION LEVEL OF BRITISH COLUMBIA'S TIMBER HARVEST

FOREST RESOURCE DEVELOPMENT AGREEMENT

Canada

BC

FRDA REPORT 121

# INCREASING THE UTILIZATION LEVEL OF BRITISH COLUMBIA'S TIMBER HARVEST

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# INCREASING THE UTILIZATION LEVEL OF THE B.C. ANNUAL TIMBER HARVEST

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# 1. INTRODUCTION

Many definitions will be important in exploring the economic prospects of increasing the utilization of B.C. timber harvests in the 1990's. The annual harvest has many dimensions: for example, the area and inventory-volume which is clear-felled, the area/volume selectively felled, the scaled timber volume extracted, the volume of residuals left on the forest floor, and the volume by grade which reaches various manufacturing facilities.

The problem of understanding utilization of the harvest is complicated by inter-industry transfers (e.g. over 30% of log inputs to sawmills become chip transfers to pulpmills or other fibre-based products). These fibre inputs can also be made directly from roundwood.

The forestry implications (sustainable yield) are complicated by all of the above (what products are being extracted from the forest now, and what is the forecast), by our knowledge of forest status (inventory), by a complex set of public-private tenures and by fixed formulas and models which predict physical timber supply.

The purpose of this study is to explore the economic prospects of using a higher fraction of the B.C. forest resources which are felled each year, and of harvesting a wider range of stands within the production forest. Many assumptions and definitions have been necessary to make this broad assignment operational. To the extent feasible, all such definitions/assumptions are spelled out in the report.

The study is mainly concerned with extracting more wood from forest land when it is felled (forest residues) and with harvesting areas that are available for harvest but not harvested to date because of product technical requirements or quality constraints (underutilized forests). The report does not deal in detail with mill residues, but it should be noted that if the utilization level of the forest is increased, some increase in the waste at manufacturing sites is highly probable. Some brief analysis and comments concerning this situation are thus appropriate.

The report describes what fraction of forest residues and underutilized areas have high potential for use (i.e. are marginal to use now), and gives estimates concerning the quantity and quality of this component. It discusses extraction costs, technical raw material requirements, the economics of the industry and the potential for improvements.

Both improved and new products are proposed along with market implications and government policy implications. Several business case scenarios are shown where the previously mentioned factors combine to suggest increasing utilization has a high potential. Strategic and policy recommendations are then made that support implementation.

## 2. POTENTIALLY AVAILABLE RESIDUES AND UNDERUTILIZED AREAS

### RESIDUES AVAILABLE FROM HARVESTING (INCREASED EXTRACTION)

Past estimates of logging residues are not entirely appropriate for use in predicting residues available for use in the future. While they are indicative of the general magnitude to be expected they will reflect the utilization and merchantability limits in effect at the time of harvest. Future harvests (i.e. next 20 years) will give residues according to utilization and merchantability limits imposed, and these are usually set in relation to stand volumes and the quality of the timber.

In general, the amount of logging residues will vary according to the limits imposed and the strictness which which monitoring and enforcement is applied. Some residues are not used because they cannot be extracted and manufactured profitably, while others are not used because they do not meet technical requirements concerning products being manufactured. In the medium term period of adjustment, stricter enforcement of utilization standards in the woods will generate increased quantities of "residues" at various mill sites.

The following tables identify by Region (seven Regions including both Prince Rupert Coast or North Coast, as well as Prince Rupert Interior) available forest residues. The estimates were derived from forest inventory data used for the 1984 Forest and Range Resource Analysis. The process used was one of identifying stands eligible for harvest by species group, site class, age class and stem size. An average sample (hectares) approximating one years harvest was then used to establish merchantable volumes, marginal small tree volumes and sound wood in waste and breakage. The merchantable volumes relate to current utilization and basic future utilization. The small tree volumes and sound wood in waste and breakage relate to increased utilization subject to the technical specifications for forest products, the market prices for forest products and utilization standards effected by the Crown (Table 1). In Table 2 the figures are shown on a cubic metre per hectare basis.

In order to estimate annual availability the allowable cut (Crown land) for the province and each Region was equated to the volumes per hectare in Table 2. Thus a projected annual area harvested could be established as well as an estimate of the related volumes including marginal or residual wood. These estimates are shown in Table 3. The important point to note is that these estimates are premised on a provincial Crown AAC of 75 million m3 and that the harvest comes from land that is expected to be harvested in the next 20 years. Some brief checks by the consultant indicate that merchantable volumes per hectare decline as might be expected if "merchantable" relates to a relationship established when harvesting higher volume stands in the past, but that this can be partially offset by harvesting smaller trees. No long term effects were considered vis-a-vis the projected annual area harvested, but sufficient hectares are available for more than 20 years harvest for the species groups specified in each Region.

Table 1. Merchantable and Marginal Wood in Standing Timber,[1] Crown T.S.A.'s by Forest Region.

| REGION & SPECIES | ANNUAL AREA TEST HARVESTED | MERCH. VOLUME | MARGINAL[2] SMALL TREES | MARGINAL[3] FROM WASTE & BREAKAGE | TOTAL AVAILABLE |
|---|---|---|---|---|---|
| | (ha) | (---------- thousands of m3 ----------) | | | |
| CARIBOO | | | | | |
| D. Fir | 5,649 | 1,280.0 | 49.5 | 41.7 | 1,371.2 |
| R. Cedar | 661 | 231.0 | 0.9 | 70.5 | 302.4 |
| Hemlock | 203 | 88.0 | 1.5 | 7.7 | 97.2 |
| Balsam | 1,132 | 234.0 | 18.0 | 20.7 | 272.7 |
| Spruce | 6,029 | 2,573.0 | 81.2 | 70.5 | 2,724.7 |
| L. Pine | 27,212 | 4,869.0 | 1,309.1 | 195.6 | 6,373.7 |
| Y. Pine | 44 | 6.0 | 0.5 | 0.1 | 6.6 |
| All Species | 40,930 | 9,281.0 | 1,460.7 | 406.8 | 11,148.5 |
| KAMLOOPS | | | | | |
| D. Fir | 5,926 | 1,194.0 | 33.0 | 34.0 | 1,261.0 |
| R. Cedar | 1,209 | 455.0 | 2.9 | 136.1 | 594.0 |
| Hemlock | 1,020 | 487.0 | 2.7 | 47.5 | 537.2 |
| Balsam | 2,957 | 815.0 | 45.3 | 89.8 | 950.1 |
| Spruce | 6,345 | 2,935.0 | 87.9 | 77.6 | 3,100.5 |
| L. Pine | 11,699 | 2,337.0 | 591.0 | 65.4 | 2,993.4 |
| Y. Pine | 449 | 53.0 | 3.1 | 1.1 | 57.2 |
| Larch | 175 | 57.0 | 2.9 | 1.8 | 61.7 |
| All Species | 29,780 | 8,333.0 | 768.8 | 453.3 | 9,555.1 |
| NELSON | | | | | |
| D. Fir | 1,933 | 535.0 | 14.4 | 13.3 | 562.7 |
| R. Cedar | 653 | 259.0 | 1.5 | 67.2 | 327.7 |
| Hemlock | 1,106 | 460.0 | 2.7 | 60.9 | 523.6 |
| Balsam | 2,186 | 492.0 | 19.1 | 62.2 | 573.3 |
| Spruce | 4,824 | 2,018.0 | 18.5 | 59.2 | 2,095.7 |
| L. Pine | 4,305 | 907.0 | 256.8 | 27.1 | 1,190.9 |
| Y. Pine | 25 | 4.4 | 0.4 | 0.1 | 4.9 |
| Larch | 716 | 227.3 | 14.1 | 9.5 | 250.9 |
| All Species | 15,748 | 4,902.7 | 327.5 | 299.5 | 5,529.7 |

Table 1 Cont'd

| REGION & SPECIES | ANNUAL AREA TEST HARVESTED | MERCH. VOLUME | MARGINAL SMALL TREES | MARGINAL FROM WASTE & BREAKAGE | TOTAL AVAILABLE |
|---|---|---|---|---|---|
| | (ha) | (---------- thousands of m3 ----------) | | | |
| PR GEORGE | | | | | |
| D. Fir | 358 | 129.5 | 5.5 | 3.1 | 138.1 |
| R. Cedar | 473 | 167.2 | 0.5 | 15.6 | 183.3 |
| Hemlock | 237 | 101.7 | 5.5 | 5.7 | 112.9 |
| Balsam | 8,630 | 1,804.6 | 106.1 | 131.8 | 2,042.5 |
| Spruce | 19,386 | 6,112.0 | 392.7 | 242.0 | 6,746.7 |
| L. Pine | 20,858 | 4,939.3 | 858.2 | 172.9 | 5,970.4 |
| Larch | 8 | 1.0 | 0.2 | 0.4 | 1.6 |
| All Species | 49,950 | 13,255.3 | 1,368.7 | 571.5 | 15,195.5 |
| PR RUPERT (Interior)[4] | | | | | |
| R. Cedar | 3 | 1.1 | 0.0 | 0.1 | 1.2 |
| Hemlock | 878 | 433.0 | 19.0 | 24.0 | 476.0 |
| Balsam | 2,546 | 605.0 | 26.7 | 44.0 | 675.7 |
| Spruce | 2,669 | 704.0 | 57.0 | 28.0 | 789.0 |
| L. Pine | 3,874 | 847.0 | 154.0 | 32.0 | 1,033.0 |
| All Species | 9,970 | 2,590.1 | 256.7 | 128.1 | 2,974.9 |
| PR RUPERT (Coast)[4] | | | | | |
| R. Cedar | 1,101 | 477.5 | 25.5 | 161.5 | 664.5 |
| Hemlock | 3,674 | 2,145.5 | 112.1 | 166.4 | 2,424.0 |
| Balsam | 1,595 | 1,430.0 | 8.6 | 74.6 | 1,513.2 |
| Spruce | 480 | 330.0 | 2.5 | 19.9 | 352.4 |
| All Species | 6,850 | 4,383.0 | 148.7 | 422.4 | 4,954.1 |
| VANCOUVER | | | | | |
| D. Fir | 1,907 | 836.0 | 64.1 | 55.4 | 955.5 |
| R. Cedar | 5,401 | 2,611.0 | 47.9 | 582.0 | 3,240.9 |
| Hemlock | 7,728 | 4,958.0 | 144.0 | 387.0 | 5,489.0 |
| Balsam | 2,282 | 1,773.0 | 22.0 | 133.0 | 1,928.0 |
| Spruce | 348 | 252.0 | 2.1 | 17.1 | 271.2 |
| All Species | 17,666 | 10,430.0 | 280.1 | 1,174.5 | 11,884.6 |

Footnotes to Table 1

1. Based on the Ministry of Forests Inventory Branch Yield System and forested areas by species groups, age classes and site classes as reported in the 1984 Forest and Range Resource Background Report. Annual harvest on Crown land in Timber Supply Areas taken from the 1985/86 Annual Report of the Ministry of Forests. Species use taken as proportional to cut. Site class use taken as 80% of good, 80% of medium and 50% of poor. Age class use taken as 7, 8 and 9 except for Lodgepole pine taken as 5, 6, 7, 8 and 9. Coast merchantable based on 22.5 cm DBH and 15 cm top. Interior merchantable based on 17.5 cm DBH and 10 cm top. Ministry of Forests "zero tolerance" for available waste assumed in effect.

2. Marginal small trees on the Coast are defined as those having 17.5 cm to 22.5 cm DBH. In the Interior they are defined as having 12.5 to 17.5 cm DBH. Note that the Ministry of Forests considers Lodgepole pine 12.5+ cm as merchantable, but for the purposes of this report 12.5 to 17.5 is classified as marginal.

3. Marginal wood from waste and breakage includes pieces that combine both decay and firm wood (i.e. firmwood rejects) as well as pieces which result from bucking out defect or breakage. In general, the former pieces are usually much larger than the latter.

4. The annual area test harvested for the Rupert Region in total was approximately 17,000 hectares. However, in 1985/86 hectares cut were about 16,000 in the Interior and about 1,000 on the Coast. For test purposes the 16,000 is excessive while the 1,000 is inadequate. For this reason the test in Rupert Interior was decreased to 10,000 hectares and the test for the Coast increased to 7,000 hectares.

Table 2. Merchantable and Marginal Wood in Standing Timber, Per Hectare Volumes by Forest Region

| REGION & SPECIES | MERCH. VOLUME | MARGINAL SMALL TREES | MARGINAL FROM WASTE & BREAKAGE | TOTAL AVAILABLE |
|---|---|---|---|---|
| | (---------- m3 per ha ----------) | | | |
| CARIBOO | | | | |
| D. Fir | 227 | 9 | 7 | 243 |
| R. Cedar | 349 | 1 | 107 | 457 |
| Hemlock | 433 | 7 | 38 | 479 |
| Balsam | 207 | 16 | 18 | 241 |
| Spruce | 427 | 13 | 12 | 452 |
| L. Pine | 179 | 48 | 7 | 234 |
| Y. Pine | 136 | 11 | 2 | 150 |
| All Species | 227 | 36 | 10 | 273 |
| KAMLOOPS | | | | |
| D. Fir | 201 | 6 | 6 | 213 |
| R. Cedar | 376 | 2 | 113 | 491 |
| Hemlock | 477 | 3 | 47 | 527 |
| Balsam | 276 | 15 | 30 | 321 |
| Spruce | 463 | 14 | 12 | 489 |
| L. Pine | 200 | 51 | 6 | 256 |
| Y. Pine | 118 | 7 | 2 | 127 |
| Larch | 326 | 17 | 10 | 353 |
| All Species | 280 | 26 | 15 | 321 |
| NELSON | | | | |
| D. Fir | 277 | 7 | 7 | 291 |
| R. Cedar | 397 | 2 | 103 | 502 |
| Hemlock | 416 | 2 | 55 | 473 |
| Balsam | 225 | 9 | 28 | 262 |
| Spruce | 418 | 4 | 12 | 434 |
| L. Pine | 211 | 60 | 6 | 277 |
| Y. Pine | 176 | 16 | 4 | 196 |
| Larch | 317 | 20 | 13 | 350 |
| All Species | 311 | 21 | 19 | 351 |

Table 2 (Cont'd)

| REGION & SPECIES | MERCH. VOLUME | MARGINAL SMALL TREES | MARGINAL FROM WASTE & BREAKAGE | TOTAL AVAILABLE |
|---|---|---|---|---|
| | (---------- m3 per ha ----------) | | | |
| PR GEORGE (Central) | | | | |
| D. Fir | 362 | 15 | 9 | 386 |
| R. Cedar | 353 | 1 | 33 | 388 |
| Hemlock | 429 | 23 | 24 | 476 |
| Balsam | 209 | 12 | 15 | 237 |
| Spruce | 315 | 20 | 12 | 348 |
| L. Pine | 237 | 41 | 8 | 286 |
| Larch | 125 | 19 | 50 | 194 |
| All Species | 265 | 27 | 12 | 304 |
| PR RUPERT (Interior) | | | | |
| R. Cedar | 367 | 0 | 33 | 400 |
| Hemlock | 493 | 22 | 27 | 542 |
| Balsam | 238 | 10 | 17 | 265 |
| Spruce | 264 | 21 | 10 | 296 |
| L. Pine | 219 | 40 | 8 | 267 |
| All Species | 260 | 26 | 13 | 298 |
| PR RUPERT (Coast) | | | | |
| R. Cedar | 434 | 23 | 147 | 604 |
| Hemlock | 584 | 31 | 45 | 660 |
| Balsam | 897 | 5 | 47 | 949 |
| Spruce | 688 | 5 | 41 | 734 |
| All Species | 640 | 22 | 62 | 724 |
| VANCOUVER | | | | |
| D. Fir | 438 | 34 | 29 | 501 |
| R. Cedar | 483 | 9 | 108 | 600 |
| Hemlock | 642 | 19 | 50 | 710 |
| Balsam | 777 | 10 | 58 | 845 |
| Spruce | 724 | 6 | 49 | 779 |
| All Species | 590 | 16 | 66 | 672 |

SOURCE: Derived from Table 1 by dividing volumes by Annual Area Harvested.

Table 3. Estimated Merchantable and Marginal Wood with Potential for Manufacture, by Forest Region, for all Crown Managed Lands[1]

| FOREST REGION | PROJECTED ANNUAL AREA HARVESTED | MERCH. or SAWABLE | MARGINAL SAW | FIBRE or PULP | TOTAL |
|---|---|---|---|---|---|
| | (ha) | 000's m3 | | | |
| Cariboo | 45,000 | 10,215 | 810 | 1,260 | 12,285 |
| Kamloops | 35,000 | 9,800 | 455 | 980 | 11,235 |
| Nelson | 25,000 | 7,775 | 250 | 750 | 8,775 |
| Pr. George | 60,000 | 15,900 | 780 | 1,560 | 18,240 |
| Pr. Rupert (I) | 25,000 | 6,500 | 325 | 650 | 7,475 |
| Pr. Rupert (C) | 2,000 | 1,280 | 22 | 146 | 1,448 |
| Vancouver | 40,000 | 23,600 | 320 | 2,960 | 26,880 |
| All | 232,000 | 75,070[2/] | 2,962 | 8,306 | 86,338 |

1. Derived from Table 2 using sufficient annual hectares of harvest, having species proportions based on recent regional harvests, to approximate an annual harvest of 75 million m3 for all Crown Managed Lands. Marginally sawable wood is largely from trees between 20 and 22.5 cm DBH on the Coast and between 15 and 17.5 cm DBH in the Interior; which is approximately one-half the volume shown in column 2, Table 2, times the projected area harvested.

2. Timber Supply Areas AAC - 56 million m3
   Tree Farm Licences AAC - 19 million m3
   Total AAC - 75 million m3

Table 4 provides estimates similar to Table 3, but for private land. This table relies heavily on recent trends. Note that the cut could change up or down significantly depending on economic and market factors. Note also there is a wide diversity of forest types and stocking on private land. The figures presented include high volume per hectare old growth as well as low volume per hectare second growth.

Table 4. Estimated Merchantable and Marginal Wood with Potential for Manufacture, by Forest Region, for all Privately Managed Lands[1]

| FOREST REGION | PROJECTED ANNUAL HARVEST | MERCH. OR SAWABLE | MARGINAL SAW | FIBRE OR PULP | TOTAL |
|---|---|---|---|---|---|
| | (ha) | ---------- | 000 m3 | ---------- | |
| Cariboo | 900 | 215 | 16 | 40 | 271 |
| Kamloops | 1,100 | 337 | 14 | 51 | 402 |
| Nelson | 3,200 | 985 | 34 | 142 | 1,161 |
| Pr. George | 3,600 | 846 | 49 | 142 | 1,037 |
| Pr. Rupert (I) | 600 | 140 | 8 | 23 | 171 |
| Pr. Rupert (C) | 50 | 29 | 1 | 4 | 34 |
| Vancouver | 7,370 | 5,748 | 44 | 676 | 6,468 |
| All | 16,820 | 8,300[2/] | 166 | 1,078 | 9,544 |

1. Derived from MOF Inventory Branch Yield System Information for medium and good sites using Nawitka data and MOF data for areas and volumes harvested.

2. Estimated Annual Cut:

| | | |
|---|---|---|
| Crown Granted Lands | - | 5.9 million m3 |
| Timber Licences Not Managed by the Grown | - | 2.4 million m3 |
| Total | - | 8.3 million m3 |

Tables 3 and 4 are used in this report to approximate the additional volumes of wood available for manufacture if harvesting continues at an annual rate of about 75 million m3 on Crown land and an annual rate of about 8.3 million m3 on private land. The additional volumes are premised on both a public policy that supports increased utilization (i.e. zero tolerance, etc.) and a continuing real price increase for sawable and pulpable fibre that has existed historically. On this basis up to 11.3 million m3 would be available from Crown lands and some 1.2 million m3 from private lands.

## WOOD AVAILABLE FROM UNDERUTILIZED AREAS (HARVESTING STANDS PREVIOUSLY AVOIDED)

Underutilized areas cannot be estimated for each Region without detailed computer assisted analyses at the TSA level in each Region, which was beyond the scope of this report. However, broad estimates can be formulated for general areas using summarized inventory data that will show the potential for cedar and hemlock in the Interior Wet Belt and on the Coast. Similarly, the potential for poor quality hemlock stands can be estimated for the Prince Rupert Interior area with respect to the Kalum, Kispiox and Bulkley Timber Supply Areas.

Table 5 summarizes by Regional location the total estimated volumes of cedar or hemlock within the location. This figure was then refined to estimate the volume that would be available without major access development. Deductions were also made concerning poor site, low volume stands of below average height. The estimated available volumes shown are believed to be realistic in terms of potential for harvest in the next 20 years. It should be noted that the estimates for the Kamloops and Nelson Region are believed to be conservative. In essence, better access and information have provided a more accurate or focused definition of these stands. Other stands might be still available under the "decadent" or "underutilized" classification that are currently classed as inoperable or unmerchantable in these two particular regions.

Table 5 indicates that there is a vast accumulation of unused lower quality wood in British Columbia. Of particular interest in this study is the 137 million m3 of hemlock on the South and Mid Coast and the 1266 million plus m3 on the North Coast. The North and Western portions of the Prince Rupert Interior Region are estimated to have a further 136 million m3 of low quality hemlock stands. In the Kamloops and Nelson Region some 29 million m3 of decadent hemlock and 20 million m3 of cedar are believed to be readily accessible.

## INCREASED LEVELS OF UTILIZATION

### Extraction Costs

In order to use the residual wood previously described, it must be harvested and transported to a utilization centre. This process must relate the timber mix being extracted and the intended use (manufactured product) being contemplated. The extraction costs presented are thus unique to several circumstances and should not be construed as average regional logging costs supporting current sales or markets.

Table 5. Estimated Availability of Decadent Hemlock and Cedar[1] Stands in B.C.

| REGION | ESTIMATED TOTAL VOLUME[2] | | ESTIMATED AVAILABLE VOLUME[3] | |
|---|---|---|---|---|
| | Hemlock | Cedar | Hemlock | Cedar |
| | millions of m3 | | | |
| Vancouver & Mid Coast | 366 | 238 | 137 | 89 |
| Pr. Rupert Coast | 339 | 87 | 126 + 87[4] | 32 + 22[4] |
| Total Coast | 705 | 325 | 263 | 121 |
| Pr. Rupert Interior | 182 | -- | 136 | -- |
| Kamloops | 29 | 26 | 14[5] | 13[5] |
| Nelson | 31 | 15 | 15[5] | 7[5] |
| Total Interior | 242 | 41 | 165 | 20 |
| Total Province | 947 | 366 | 428 | 141 |

1. Considers only those stands where the lead species is hemlock or cedar. Age in all cases is greater than 140 years. Site is poor (majority) or medium (minority).

2. Net decay waste and breakage on an inventory basis for trees 22.5+ cm DBH on the coast and 17.5+ cm in the Interior.

3. Derived from column 1 and 2 on the basis of information reported in TSA reports and the 1984 Forest and Range Resource Analysis that indicates quality, merchantability, or accessibility.

4. A further 87 million m3 of hemlock and 22 million m3 of cedar might be accessible in conjunction with expanded access to harvest merchantable timber.

5. The decadent hemlock and cedar estimated as available in the southern Interior is readily accessible as most of the stands are adjacent to or traversed by active road systems.

SOURCE: Derived from Inventory Information (MOF Inventory Branch) analyzed on the basis of species groups, site class, age class and height.

Better utilization scenarios refer to extracting timber previously left as residuals or logging waste because of its smaller size. In these scenarios no increase in defect is considered. In this situation felling, bucking and particularly yarding, increase in cost. Note, however, that other cost components can decline. New roads are not charged against this material so there is no increase in average road building costs. Similarly, camp costs and crew transport, where applicable, should not increase. Stumpage on the average would only increase a few cents at the current rate of $0.25/m3.

The costs were compiled on the basis of adding some extra small material to current extracting costs which incurs higher yarding costs as the major factor. Note that the extraction of this material was considered on a cost basis in order to ascertain whether new (or improved and expanded) manufacturing opportunities were viable. For this reason profit and risk allowances were largely excluded as were any overheads not directly related to logging. This then reflects a basic extraction cost that can be used in testing manufacturing opportunities.

Harvesting decadent stands presents another set of unique circumstances. These stands have not been harvested to date because of their lower quality or higher defect content vis-a-vis use in traditional products. The stands that are of immediate interest will be those that have been previously passed by. Their location is widespread and many of them (but not all) on the Coast relate to marine transport situations. At some locations basic road systems would need to be reopened and camps would be likely. This timber could be logged efficiently with current equipment designed to handle large logs and stumpage charges would be minimal in comparison to better quality stands. Thus, some components of the logging cost would be less than is the case with current logging. On the other hand some adjustment would be necessary in removing more decay than is currently encountered.

Similarly, if the objective is to extract reasonable volumes of these large logs some defect (more than normal) would be taken out with the logs. For these reasons the extraction costs estimated for decadent have a "decay removal adjustment". This additional cost was added to reflect minor changes in felling and bucking practices as well as to compensate for the removal of more defective material within a transportable log that is best removed at a processing facility.

Table 6 estimates extraction costs for coastal situations and Table 7 estimates the costs for Interior situations. These costs are used in the analyses and utilization scenarios presented in parts of the report that follow.

Table 6. Estimated Total Extraction Costs, B.C. Coast, Delivered to Utilization Centre ($/m3), 1989[1]

BETTER UTILIZATION SCENARIOS

| Activity | South Coast and Vancouver Island | Mid Coast |
|---|---|---|
| Logging | 23.80 | 33.60 |
| Haul/Barge | 6.50 | 8.50 |
| Stumpage | 9.00 | 8.50 |
| Total Delivered Cost | 39.30 | 50.60 |
| Pulpwood Cost Net[2] | 29.50 | 33.95 |

HARVESTING DECADENT SCENARIOS

| Activity | South Coast | Mid Coast | North Coast |
|---|---|---|---|
| Logging | 27.50 | 29.25 | 29.95 |
| Haul/Barge | 7.00 | 7.50 | 8.75 |
| Stumpage | 2.50 | 2.50 | 2.25 |
| | 37.00 | 39.25 | 40.95 |
| Decay Removal Adjustment | 3.25 | 3.45 | 2.70 |
| Total Delivered Cost | 40.25 | 42.70 | 43.65 |
| Pulpwood Cost Net[2] | 30.20 | 32.00 | 32.75 |

HARVESTING UNDERUTILIZED TIMBER

| Activity | South Coast Alder |
|---|---|
| Logging | 17.00 |
| Haul/Barge | 7.00 |
| Stumpage | 1.50 |
| Total Delivered Cost | 25.50 |

SOURCE: Compiled from Nawitka file data and published reports.

Footnotes to Table 6 and Table 7

1. Not including profit attributable to logging or indirect overheads. Profit (or loss) is considered for the total wood processing enterprise (not for one stage) as discussed in this report. Similarly, indirect overheads such as office and administration are charged to the enterprise in total and not to logging in particular.

2. The total stand (extracted timber) is available at the delivered cost specified. It is unlikely that the entire stand would be suitable for the low quality wood processing options proposed. Log trading or use of a market mechanism is highly likely which will place some material at a higher value (i.e. sawlogs) and some material at a lower value (i.e. pulpwood).

   In order to establish a value for pulpwood, ratio's were calculated using 1989 data from the Vancouver Log Market (i.e. pulpwood prices in relation to the average market price). This value would be appropriate for all situations where the stand has a significant sawlog component. In the case of stands that are very decadent a significant sawlog component may not be the case. In such situations the fibre or pulpwood component would have to bear a value that was closer to the extraction cost in order to justify stand harvesting.

Table 7. Estimated Total Extraction Costs, B.C. Interior, Delivered to a Utilization Centre ($/m3), 1989[1]

BETTER UTILIZATION SCENARIOS

| Activity | Cariboo | Kamloops | Nelson | Pr George | Pr Rupert (I) |
|---|---|---|---|---|---|
| Logging | 13.50 | 15.40 | 15.65 | 17.90 | 19.50 |
| Hauling | 9.75 | 8.75 | 8.00 | 8.00 | 7.75 |
| Stumpage | 2.65 | 3.50 | 3.10 | 4.45 | 4.15 |
| Total Delivered Cost | 25.90 | 27.65 | 26.75 | 30.35 | 31.40 |
| Pulpwood Cost Net[2] | 22.00 | 23.50 | 22.75 | 25.80 | 26.70 |

HARVESTING DECADENT SCENARIOS

| Activity | Hemlock or Cedar Kamloops | Nelson | Hemlock Pr Rupert (I) |
|---|---|---|---|
| Logging | 13.75 | 14.00 | 16,75 |
| Hauling | 7.75 | 7.00 | 7.00 |
| Stumpage | 1.50 | 2.00 | 2.25 |
| | 23.00 | 23.00 | 26.00 |
| Decay Removal Adjustment | 2.25 | 2.25 | 1.50 |
| Total Delivered Cost | 25.25 | 25.25 | 27.50 |
| Pulpwood Cost Net[2] | 18.95 | 18.95 | 20.60 |

HARVESTING UNDERUTILIZED TIMBER

| Activity | Aspen Pr George | Aspen Pr Rupert (I) |
|---|---|---|
| Logging | 13.00 | 14.00 |
| Hauling | 7.00 | 6.75 |
| Stumpage | 0.50 - 2.50 | 0.50 - 2.50 |
| Total Delivered Cost | 20.50 - 22.50 | 21.25 - 23.25 |

SOURCE: Compiled from Nawitka file data and published reports.

## 3. PRODUCT OPPORTUNITIES FOR INCREASED UTILIZATION

### INTRODUCTION

Product opportunities for increased utilization include sawn products which are variations of current products produced in British Columbia, increased use of fibre in chip form for a variety of pulp furnishes and other products which do not relate directly to the above.

Because of the importance of pulpable fibre the economics of that situation will be discussed in detail in a separate chapter. Various methods and strategies for increased chip yields are, however, discussed below.

A wide variety of products are technically producible from the increased supply that was identified earlier in the report along with its cost of extraction. This material falls into two broad groups: "smallwood" which involves increased utilization of tops, small trees, and stands with smaller trees in general; and "decadent" which implies larger trees and logs, but a decrease in quality. In general, sound wood is less and/or stain, decay and knots increase.

All products proposed are subject to adequate supplies being available in the Region of interest and that extraction costs are favourable. In addition, basic factors concerning production or manufacture must be available as needed (road access, rail, labour, infrastructure, gas and electricity, etc.). These considerations provide a link to, and necessarily become part of, any strategy for increased utilization.

### Reconstituted Panel Products

For the given range of forest residuals for consideration, several panel types are producible, including:

- Medium Density Fibreboard (MDF)
- Oriented Strand Board/Waferboard (OSB)
- Particleboard
- Wet Process Hardboard
- Densified Panels ("Werzalit")

Of this product grouping, the first three (MDF, OSB and Particleboard) are technologically proven, state-of-the-art products, are marketable for domestic and/or export shipments and have relatively low emission levels for air and effluent quality.

Wet Process Hardboard, while still an important product globally, is being rapidly displaced by higher quality panel products. Further, the process poses considerable environmental risk due to discharge or potential

discharge of water borne pollutants in the form of solubilized wood and chemical components, as well as fine fibre which has remained suspended in its white water system. For reasons of both environmental concern and decreasing market/sales return potential, this product has been eliminated from the product grouping in this study.

Densified panels or moulded products (e.g. "Werzalit") have been produced for some years in Europe, and have recently had some success at production in North America. This process consumes up to 22 percent resin solids based on panel weight (versus 0.5-8 percent for "conventional" panel products) and is a substantial consumer of petro-chemical based resins. The product range producible includes a gamut from table tops to caskets, however, has a highly specialized market serving specific "niches" from specific plants. Further, the producer plants are relatively small, consuming between 20-40,000 m3/annum of wood residues. For reasons of specialization, consuming capacity and high non-renewable resource consumption, this product has been eliminated from further analysis.

## Chemicals and Cattle Feeds

A wide variety of chemicals and cattle feed products are technically feasible for production from forest residues.

Chemicals ranging from simple alcohols to pharmaceuticals, flavonins and resinous products are theoretically producible from a variety of lignocellulosic materials, including the range of forest residues contemplated in this study. With few highly specialized and highly localized exceptions, these processes are not currently viable economically, nor are most of them conducive to consumption of substantial volumes of residues.

For reasons of economics and bulk utilization, further analysis of chemical production has been eliminated from this study.

Cattle feeds, notably from a chemi-thermal patented process ("Pro-Cell" by Stake Technology Ltd.) are producible from lignocellulosic forest residues. However, of the pilot plants started on this process in both Canada and the U.S., only hardwoods in roundwood form have been used and economic results have not been outstanding.

Single cell protein (SCP) is equally producible from a wide variety of forest residues and milling process residues. Of the pilot operations in both Europe and North America, economic performance has been marginal, against enormous capital investment. The product has not gained governmental approval for utilization in human foodstuffs (except in secondary feeding of chickens and swine), and has been relegated to the lower value markets for pet and farm animal feeds, where it must compete with the more stable and predictable soya lecithins.

Both of these ranges of product has been eliminated for further examination in this study.

## Sawmill Products (Hardwoods)

It has been assumed that the furnish suitable for input to modern and efficient softwood sawmills is already being extracted from the forests. However, the hardwoods (alders, poplars and birches), which are available in many regions of the province, are still available for processing.

Hardwoods have had an unfortunate history in British Columbia sawmilling, with many attempts ending in economic failure, for a wide variety of reasons. In general, failure has resulted from:

- low recovery factor due to sawmill equipment configuration
- lack of markets for low-grade lumber
- lack of markets for chips produced.

Recent technological changes in equipment design, market requirements and pulpmill utilization have now re-opened the possibility of hardwood sawing. Sawnwood has therefore been included in this study, but with the market and product range restricted to high value furniture components and low value pallet stock.

## Sliced Veneer

During the period of 1934 through 1968 two to three slicing operations intermittently produced sliced birch, cedar and pine in British Columbia. Since 1976, only one slicing operation has concentrated on cedar and pine (unsuccessfully), while a second operation (Surrey Veneer Ltd.) has successfully operated a slicing plant producing a wide range of sliced veneer products ranging from knotty western red cedar to clear Douglas fir.

In addition to local production of sliced veneers, two U.S. based slicing plants source "cants" for slicing cedar and pine from the Kootenay region of B.C., where by careful selection of wood characteristics, a highly desirable product for decorative panelling may be produced. This product was tested for expanded production.

## Sawmill Products (Softwoods)

In extension of forest utilization, smallwood pines (and other softwoods) down to a 5 cm top DIB range may be extracted for utilization in existing sawmill complexes. It has been assumed that these materials (i.e. top DIB 5.0 cm to 10.0 cm) may be sawn to 1" and 2" lumber, with residuals recovered as pulp chips.

As this wood processing would be an adjunct to an existing sawmill, the capital and operating costs for the smallwood utilization could be kept to a minimum and product sales would be merely an addition to existing softwood dimension lumber sales.

## Pulpwood

Pulpwood furnish from logging operations could include a wide range of forest residuals ranging from broken pieces through whole but largely decadent trees, to standing small timber (top DIB 5 - 15 cm). These furnish types can be considered for the production of "pulp" type chips, although the final utilization of the chips could be for reconstituted panel products (MDF or particleboard) as well as pulp production, depending on the economics of the utilizing industry.

## Sawnwood - Hemlock

The coastal regions of British Columbia are relatively heavily stocked with over-mature and decadent hemlock. This material may be considered as a source for a new facility to process this wood to a combination of selected cants, lumber and pulp chips. Although material losses are expected to be high due to irregular shape, length and high rot content of logs, saleable product may be producible from this under-used raw material source.

## Testing Opportunities

A feasibility model was used to test opportunities and situations concerning the above products. The results are discussed on the following pages. An example of the model specifications for one product is shown in Appendix 1.

# OPPORTUNITIES FOR MEDIUM DENSITY FIBREBOARD

MDF is a panel product producible from a wide variety of wood species, including both hardwood and softwoods. The basic process involves the pressurized attrition defribration of wood chips, in much the same manner as thermomechanical pulping, and identically the same as wet process hardboard. The chips are reduced to fibre bundles (1-2.5 cm x 0.25 mm), then blended with wax and resin (phenolic or ureaformaldehyde) and dried. Dried fibre is then deposited to a mat, which is pre-compacted, prepressed then consolidated under heat and pressure to form a panel of rough dimensions in multiples of the final dimensions, and in thicknesses from 9 to 27 mm. The rough panel is then trimmed and cut to size as per market specifications, sanded, graded and shipped.

Primary uses of MDF include furniture and case goods manufacture, crating, room dividers and (if phenolic bonded) sheathing structural applications.

## Raw Materials

MDF is producible from a wide variety of wood species, both in roundwood and/or sawmill residue forms. Table 8 presents a basic specification for MDF furnish. It is emphasized that, while species may be mixed in this product, the mixing may have to be in metered ratios, and that raw materials must be segregated and stored by species prior to defibration.

Table 8. Raw Material Specification - Medium Density Fibreboard

| | |
|---|---|
| Type of Furnish: | Roundwood<br>Green sawmill waste (slabs and edgings, green planer shavings), mill residues, pulp chips.<br>Note: May use a mixture of roundwood and mill residues |
| Species: | All B.C. softwood species<br>Hardwoods: aspen and alder<br>Note: Species may be mixed in fixed ratios |
| Moisture Content: | 20-150% |
| Bark in Raw Material: | Roundwood - to mill infeed with bark on<br>Mill residues - maximum 1% bark |
| Bark in Furnish: | Maximum 1% after screening |
| Fines in Furnish: | Maximum 4% after screening |
| Rot: | Maximum 1% after screening<br>Maximum 10% before chipping |
| Furnish Dimensions: | Chip sizes - 5 cm x 3 cm x 3 cm |
| Sand in Furnish: | 0% |

## Capital Cost

World scale MDF plants currently range from 90,000 to 200,000 m3 per annum output. For purposes of this analysis, capital costs for a 120,000 m3/annum output MDF plant have been used to represent a median world scale plant. Capital costs for buildings and equipment have been extracted from the consultants' files and are estimated to be approximately $46.8 million for a smallwood plant and approximately $50.4 million for a plant using decadent wood.

## Raw Materials Balance

A smallwood plant would require about 241,000 m3 annually of roundwood, and a decadent plant would require about 269,000 m3 annually of decadent wood to produce 120,000 m3 of product.

## Operating Costs and Returns

All operating costs including overheads were considered on a 1989 basis for British Columbia. Purchases were made at "the going rate" unless otherwise specified.

In estimating the feasibility of establishing a plant, the criteria used was "net revenue". The variables considered in general were a high and a low wood cost.[1] A high and a lower labour rate was also considered, and either normal or incentive utility and tax rates. Net mill returns for MDF will continue to be in the $265 to $275/m3 range, with some improvement ossible in the future if exports to Asia increase. The expected net selling value of the product was held constant at $270/m3.

## MDF Feasibility

Summary Table 9 indicates opportunities for MDF by region. The table addresses the opportunities in terms of type of wood, wood cost, labour cost, and utilities and tax rates. Only selected opportunities are shown in the table. Many situations were clearly not feasible and were discarded. Some opportunities, however, were shown that were not feasible (i.e. significant negative net revenues) were retained to add perspective as to which variables were sensitive in determining feasibility.

For MDF most smallwood options were not viable regardless of region. The best opportunity appears to be in the Cariboo Region using small pine as a furnish. Note the manufacture of MDF is moderately sensitive to wood cost, labour rate and utilities and taxes. Currently, sawing small pine with chip recovery would provide greater returns per cubic metre than the manufacture of MDF. The manufacture of decadent wood into MDF was most attractive in the Nelson or Kamloops Regions. However, the full costs option did not provide a positive return and some reduction in major costs would be necessary to establish a viable plant.

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1. The high wood cost used refers to the cost(s) of extraction as previously discussed. The low wood cost(s) refer to an assigned value based on the market concept that if the logged material is sorted, larger quality material will be priced at a high rate and lower quality smaller material will be priced at a lower rate than the extraction cost.

Table 9. Summary Table - Manufacturing Medium Density Fibreboard

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms)[1] | $/m3 | $/m3 | $000's |
| KAMLOOPS or | 25.25 | 18.50 | Normal | 270.00 | -19.50 | n.a. |
| NELSON | 25.25 | 14.00 | Incentive | 270.00 | 3.84 | 461 |
| (Decadent) | 18.95 | 18.50 | Normal | 270.00 | - 5.45 | n.a. |
| | 18.95 | 18.50 | Incentive | 270.00 | 4.15 | 498 |
| CARIBOO | 25.90 | 18.50 | Normal | 270.00 | - 7.65 | n.a. |
| (Smallwood) | 25.90 | 18.50 | Incentive | 270.00 | 1.65 | 198 |
| | 22.00 | 18.50 | Normal | 270.00 | 2.25 | 270 |
| | 22.00 | 18.50 | Incentive | 270.00 | 7.70 | 924 |
| PR GEORGE | 30.35 | 18.50 | Normal | 270.00 | -16.60 | n.a. |
| (Smallwood) | 25.80 | 18.50 | Normal | 270.00 | - 7.45 | n.a. |
| | 25.80 | 18.50 | Incentive | 270.00 | 1.85 | 222 |
| PR RUPERT (I) | 31.40 | 18.50 | Normal | 270.00 | -18.70 | n.a. |
| (Smallwood) | 31.40 | 14.00 | Incentive | 270.00 | 4.40 | 528 |
| | 26.70 | 18.50 | Incentive | 270.00 | 0.05 | 6 |
| | 26.70 | 14.00 | Incentive | 270.00 | 13.85 | 1662 |
| PR RUPERT (I) | 27.50 | 18.50 | Normal | 270.00 | -24.60 | n.a. |
| (Decadent) | 27.50 | 14.00 | Incentive | 270.00 | - 1.20 | n.a. |
| | 20.65 | 18.50 | Incentive | 270.00 | 0.34 | 41 |
| | 20.65 | 14.00 | Incentive | 270.00 | 14.15 | 1698 |
| NORTH COAST | 43.65 | 18.50 | Normal | 270.00 | -60.80 | n.a. |
| (Decadent) | 32.75 | 12.00 | Incentive | 270.00 | - 5.85 | n.a. |
| MID COAST | 42.70 | 14.00 | Incentive | 270.00 | -35.25 | n.a. |
| (Decadent) | 32.05 | 12.00 | Incentive | 270.00 | - 4.30 | n.a. |
| MID COAST | 31.50 | 14.00 | Normal | 270.00 | - 5.10 | n.a. |
| (Smallwood) | 31.50 | 14.00 | Incentive | 270.00 | 4.20 | 504 |
| SOUTH COAST | 40.25 | 14.00 | Incentive | 270.00 | -29.75 | n.a. |
| (Decadent) | 30.20 | 12.00 | Incentive | 270.00 | 0.10 | 12 |
| SOUTH COAST | 29.50 | 18.50 | Incentive | 270.00 | - 5.55 | n.a. |
| (Smallwood) | 29.50 | 14.00 | Normal | 270.00 | - 1.05 | n.a. |
| | 29.50 | 14.00 | Incentive | 270.00 | 8.25 | 990 |

1. See Appendix 2.

## OPPORTUNITIES FOR ORIENTED STRANDBOARD (WAFERBOARD)

OSB/Waferboard is a structural panel product, produced in thicknesses ranging from 9 to 27 mm, which may utilize a variety of wood species including both hardwoods and softwoods. Approximately 90 percent of current production is based on the use of poplar species. Its process involves the slicing of heat conditioned roundwood billets into "strands" or wafers, which are then dried and blended with phenolic resin and paraffin wax. Strands are then deposited to a forming line (for OSB with strand layers mechanically or electrically orientated at 90 degrees to each other). The strands/wafers are then consolidated under heat and pressure to form a rough panel, trimmed and sawn to market specifications, and shipped.

Primary uses of OSB/Waferboard include structural sheathing and crating, although with secondary application of films, it can be used on concrete form or other higher value applications.

### Raw Materials

Although OSB/Waferboard is producible from a variety and mix of wood species, species must be inventoried and processed separately (in fixed ratios) in order to preserve end-product quality standards. A basic specification for roundwood infeed is presented in Table 10.

Table 10. Raw Material Specification - OSB/Waferboard

| | |
|---|---|
| Type of Furnish: | Roundwood |
| Species: | Prefer poplar species<br>May consider red cedar/hemlock |
| Moisture Content: | 20-150% |
| Log length: | Multiples of 120 cm |
| Minimum diameter: | 5 cm |
| Bark in Raw Material: | 80% bark on |
| Bark in Furnish: | Maximum 1.5% |
| Fines in Furnish: | Maximum 4% after screening |

## Capital Costs

World scale OSB/Waferboard plants currently range from 100,000 to 530,000 m3/annum output capacities. For purposes of this analysis, capital costs for a 200,000 m3/annum output OSB/Waferboard plant have been used, and are estimated to be approximately $48.8 million for a plant using aspen, or $52.4 million for a plant using decadent cedar/hemlock.

## Raw Materials Balance

A plant using aspen would require about 345,000 m3 annually of roundwood and a plant using decadent wood would require about 377,000 m3 annually to produce 200,000 m3 of product.

## Operating Costs and Returns

Operating costs were calculated on the same basis as the previous case. The expected net selling value of the product is not expected to change for three to five years, and hence only one value was used in the analysis. Net mill sales returns for late 1989 are estimated to be $156/m3.

## OSB/Waferboard Feasibility

Summary Table 11 indicates opportunities for OSB for three regional situations. The most attractive situation appears to be in the manufacture of aspen in the Prince George Region or the Prince Rupert Interior Region.

The manufacture of OSB is moderately sensitive to wood costs, labour rates and utilities and taxes. When all these factors of production are priced high, the manufacture of OSB appears to be unattractive. However, manufacture rapidly becomes attractive if moderate prices are considered.

The manufacture of OSB from decadent wood does not appear attractive. The manufacture of aspen pulpchips appears to be very competitive with OSB at a chip price of about $35/m3. The manufacture of aspen lumber (together with some by-product chips) appears to be more attractive than either of the above opportunities with the lumber priced at market rates of $138/m3 for pallet stock and the chips at the current hardwood price of $30.00/m3.

Table 11. Summary Table - Manufacturing OSB/Waferboard

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS or | 25.25 | 18.50 | Normal | 156.00 | -30.45 | n.a. |
| NELSON | 18.95 | 18.50 | Incentive | 156.00 | -14.40 | n.a. |
| (Decadent) | 18.95 | 12.00 | Incentive | 156.00 | - 0.80 | n.a. |
| PR GEORGE | 20.50 | 18.50 | Normal | 156.00 | -12.50 | n.a. |
| (Aspen) | 20.50 | 14.00 | Incentive | 156.00 | 0.50 | 100 |
| | 18.50 | 14.00 | Incentive | 156.00 | 3.95 | 790 |
| | 18.50 | 12.00 | Incentive | 156.00 | 8.60 | 1720 |
| PR RUPERT (I) | 21.25 | 18.50 | Normal | 156.00 | -13.80 | n.a. |
| (Aspen) | 21.25 | 14.00 | Incentive | 156.00 | - 0.80 | n.a. |
| | 19.25 | 14.00 | Incentive | 156.00 | 2.65 | 530 |
| | 19.25 | 12.00 | Incentive | 156.00 | 7.25 | 1450 |

OPPORTUNITIES FOR PARTICLEBOARD

Particleboard is a panel product producible from a wide variety of hardwood and softwood species, and may be based on roundwood and/or mill residues (planer shavings and pulp chips). The basic process involves production of uniform chips or flakes from debarked wood, drying, and milling to produce a controlled mix of fines and coarse particles, followed by blending with urea formaldehyde resin and paraffin wax. The blended particles are air classified, aligned and deposited to a moving mat, then consolidated under heat and pressure to form a panel of rough dimensions and multiples of the final dimensions and thicknesses ranging from 3 to 30 mm. The rough panel is then trimmed and cut to sizes as per market specifications, sanded, graded and shipped.

Primary uses of Particleboard are wall panelling (overlaid with decorative veneers or films), furniture and case goods, appliance cases, flooring underlayment and crating.

## Raw Materials

While Particleboard can be produced from a variety of species and wood forms, raw materials must be separated, inventoried and processed by species in order to ensure end-product quality standards. Table 12 presents a primary specification for Particleboard furnish from both roundwood and mill residual sources.

Table 12. Raw Material Specification - Particleboard

| | |
|---|---|
| Type of Furnish: | Roundwood or mill residues (pulp chips and planer shavings) |
| Species: | All softwoods<br>All hardwoods<br>Note: Species can be blended in product, but must be separated in roundwood input |
| Moisture Content: | 20-150% |
| Bark in Raw Material: | Roundwood - to mill infeed with bark on<br>Mill residues - maximum 1% bark |
| Bark in Furnish: | Maximum 1% |
| Fines in Furnish: | Maximum 10% after screening |
| Rot: | Maximum 1% after screening<br>Maximum 10% before chipping |
| Furnish Dimensions: | Normal planer shavings<br>Normal pulp chips |
| Sand in Furnish: | 0% |

## Capital Costs

World scale Particleboard plants currently range from 100,000 to 600,000 m3/annum output capacities. For purposes of this analysis, capital costs for a 150,000 m3/annum plant have been used, and are estimated to be approximately $38.4 million for a smallwood plant and approximately $42.0 million for a plant using decadent wood. Capital costs have been extracted from consultant files for equipment and buildings, however, land cost has not been included. It is assumed that a suitable site would be available at a hypothetical location, fully serviced by rail, road, natural gas and electricity.

## Raw Material Balance

A smallwood plant would require about 248,000 m3 annually of roundwood and a decadent wood plant would require about 267,000 m3 annually to produce 150,000 m3 of product.

## Operating Costs and Returns

Operating costs were calculated in the same manner as in the first case presented. The expected net selling value of the product was set at the late 1989 price of $179/m3. This was the only value used in this analysis as competition from MDF in some applications is expected to hold down price increases. However, should MDF prices advance it is highly likely particleboard could follow.

## Particleboard Feasibility

Summary Table 13 indicates a wide variety of opportunities for particleboard. As with other board products manufacture is sensitive to wood costs, labour rates and utilities and taxes. Of the three above labour rates are slightly more critical. The best opportunities for smallwood use appear to be in the mid or northern Interior.

Particleboard can be manufactured in these regions provided labour rates are moderate. If they are high both reduced wood costs and incentive utility rates appear necessary for feasibility. Particleboard might also be considered for the South Coast on the same basis. In this case slightly lower wood costs would be important as incentive utility rates may not be an option in this Region.

Decadent furnish does not appear to be as attractive but might be feasible in Kamloops/Nelson or in Prince Rupert Interior if moderate labour and utility rates are considered.

Table 13. Summary Table - Manufacturing Particleboard

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS or | 25.25 | 18.50 | Normal | 179.00 | -14.55 | n.a. |
| NELSON | 25.25 | 14.00 | Incentive | 179.00 | 2.05 | 308 |
| (Decadent) | 18.95 | 18.50 | Incentive | 179.00 | 2.20 | 330 |
| | 18.95 | 14.00 | Incentive | 179.00 | 13.25 | 1988 |
| CARIBOO | 25.90 | 18.50 | Normal | 179.00 | - 6.15 | n.a. |
| (Smallwood) | 25.90 | 18.50 | Incentive | 179.00 | - 0.85 | n.a. |
| | 25.90 | 14.00 | Incentive | 179.00 | 10.20 | 1530 |
| | 22.00 | 18.50 | Incentive | 179.00 | 5.65 | 848 |
| | 22.00 | 14.00 | Incentive | 179.00 | 16.70 | 2505 |
| PR GEORGE | 30.35 | 18.50 | Incentive | 179.00 | - 8.20 | n.a. |
| (Smallwood) | 30.35 | 14.00 | Incentive | 179.00 | 2.85 | 428 |
| | 25.80 | 18.50 | Incentive | 179.00 | - 0.65 | n.a. |
| | 25.80 | 14.00 | Incentive | 179.00 | 10.40 | 1560 |
| PR RUPERT (I) | 31.40 | 18.50 | Incentive | 179.00 | - 9.95 | n.a. |
| (Smallwood) | 31.40 | 14.00 | Incentive | 179.00 | 1.10 | 165 |
| | 26.70 | 18.50 | Incentive | 179.00 | - 2.15 | n.a. |
| | 26.70 | 14.00 | Incentive | 179.00 | 8.90 | 1335 |
| PR RUPERT (I) | 27.50 | 18.50 | Incentive | 179.00 | -13.00 | n.a. |
| (Decadent) | 27.50 | 14.00 | Incentive | 179.00 | - 1.95 | n.a. |
| | 20.65 | 18.50 | Incentive | 179.00 | - 0.85 | n.a. |
| | 20.65 | 14.00 | Incentive | 179.00 | 10.20 | 1530 |
| NORTH COAST (Decadent) | 32.75 | 12.00 | Incentive | 179.00 | - 5.65 | n.a. |
| MID COAST (Decadent) | 32.05 | 12.00 | Incentive | 179.00 | - 4.40 | n.a. |
| MID COAST | 31.50 | 14.00 | Normal | 179.00 | - 4.35 | n.a. |
| (Smallwood) | 31.50 | 12.00 | Incentive | 179.00 | 6.60 | 990 |
| SOUTH COAST (Decadent) | 30.20 | 12.00 | Incentive | 179.00 | - 1.10 | n.a. |
| SOUTH COAST | 29.50 | 14.00 | Normal | 179.00 | - 1.00 | n.a. |
| (Smallwood) | 29.50 | 14.00 | Incentive | 179.00 | 4.30 | 645 |

## OPPORTUNITIES FOR ASPEN AND ALDER SAWNWOOD

Conventional sawmilling of both poplars and alder have been, or are being, undertaken in several locations for the production of dimension lumber from these groups of species. In most instances, it is not a "stand alone" operation, and these operations typically have substantial profitability problems due to low recovery, drying losses and highly critical markets.

Specialty markets exist in the furniture industry for select and framing grades of poplars, birch and alder, with additional markets for fall-down products going into pallet stock.

High recovery (volume and grade) from the hardwoods can be achieved by utilization of European technologies wherein incoming logs are debarked, visually inspected for defect and crook, and bucked at lengths of 1.5 to 4 metres in order to yield straight and sound log components. These logs are then scanned and rotated to position for maximal recovery. Positioned logs are then end-dogged to fix position, twin band sawn for opening face, then either off-set sawn or rotated. Once opening faces and boards have been removed for clear recovery, the remaining cants are edged to boards and/or resawn for recovery. The resulting products are sorted to furniture clears (for table tops, legs and other exposed areas), frames and pallet stock.

### Raw Materials

Raw material furnish to the hypothetical sawmill would be in fresh, sound log form only. Table 14 presents a basic specification for the sawmill log input.

Table 14. Raw Material Specification - Sawmill

| | |
|---|---|
| Type of Furnish: | Roundwood |
| Species: | Red alder, poplar, birch |
| Diameter: | Minimum 10 cm top DIB<br>Maximum 50 cm butt |
| Length: | Minimum 1.5 m<br>Maximum tree length |
| Quality: | Free of visible defect and rot (maximum 10% for "decadent")<br>Round, sound<br>Minimum straight section 1.5 m |

Current sales returns for hardwood lumber and expected proportion of mix is listed in Table 15.

Table 15. Net Mill Return (1989) for Sawn Alder and Aspen

| GRADE | NET MILL RETURN $US/MFBM | EST. PROPORTION OF OUTPUT B.C. COAST (Percent) | CONTRIBUTION $US/MFBM |
|---|---|---|---|
| ALDER | | | |
| Clear/Select | 950.00 | 10 | 95.00 |
| Frame | 320.00 | 15 | 48.00 |
| Pallet | 275.00 | 75 | 206.25 |
| Average Mix | | | 349.25 |
| (in Canadian $ per m3) | | | (175.00) |
| Mill Run (at Pallet Price) | | | |
| (in Canadian $ per m3) | | | (138.00) |
| ASPEN | | | |
| Mill Run or Pallet - same price as alder | | | |
| BY-PRODUCTS | | | |
| Pulp Chips (late 1989) | | Alder | Aspen |
| Domestic (f.o.b. mill) | - | $27.50 - $34.00/m3 | $27.50 - $30.00/m3 |
| Export (c.i.f. port) | - | $45.00 - $55.00/m3 | n.a. |

## Capital Cost

High value recovery hardwood sawmills range in capacity from 2,500 to 100,00 m3/annum output capacity. For purposes of this analysis, capital costs of a 50,000 m3/annum output sawmill have been used, and are estimated to be approximately $15.3 million for a mill cutting medium size sound logs. Capital costs have been extracted from consultants files for equipment and buildings, however, land cost has not been included. It is assumed that a suitable site would be available at a hypothetical location, fully serviced by rail, road, natural gas and electricity.

## Raw Material Balance

Approximately 74,000 m3 of sound logs would be needed annually to produce 50,000 m3 of lumber and 15,000 m3 of pulpchips.

## Operating Costs and Returns

All alder costs were considered on a South Coast basis for 1989. Aspen costs were considered on a Prince George basis for 1989.

The expected net selling value of the alder lumber was taken at $175/m3 for a grade mill and $138/m3 for a pallet stock or non-grading mill. Pulpchips (alder) were priced at $27.50/m3. As alder lumber demand has increased steadily over the past ten years along with a real price increase for both lumber and chips, an intermediate price scenario was estimated where mill run lumber would have a value of $152.35/m3 and pulpchips a value of $30.35/m3. Aspen lumber was priced mill run at $138/m3 and the chips at $27.50/m3, followed by an intermediate scenario.

## Hardwood Lumber Feasibility

Summary Table 16 indicates the opportunities for aspen lumber in the northern Interior of B.C. and for alder lumber on the South Coast. The manufacture of aspen lumber appears feasible in B.C. at current costs and prices. This includes full costs on all major cost items tested and with the lumber priced at pallet grade. Sufficient aspen is available in the Prince George Region to accommodate several hardwood sawmills. To date this resource has not been utilized to any degree and large mature volumes exist both west of Prince George (particularly the Vanderhoof area) and to the northeast. Large mature volumes are available throughout the Chetwynd, Dawson Creek and Fort St. John areas. Recent but limited inventory information sampled about 30 percent of this area with Dawson Creek as the central point of focus. Some 15 million m3 of mature aspen were identified including 4 million m3 on private land.[1]

The sawmill plus chips manufacturing option gave higher net returns than either the manufacture of pulpchips alone or oriented strandboard. New pulpchipping facilities using smaller aspen were estimated to be feasible on a full cost basis at a chip price of $33 to $35/m3.

The manufacture of alder lumber on the South Coast was feasible for a grade sawmill. It is also feasible for a mill to produce pallet lumber and chips from smaller, lower quality alder provided the input price of logs does not exceed $25/m3 and a chip price of $28 to $30/m3 can be obtained.

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1. Region/compartment area/volume reports based on the new "FIP" file for Block 93P, Ministry of Forests, Inventory Branch, Victoria.

Table 16. Summary Table - Aspen or Alder Sawnwood

| REGION | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| PR GEORGE (Aspen) | 22.50 | 18.50 | Normal | 138.00 + 27.50 [1/] | 2.30 | 150 |
| | 22.50 | 14.00 | Incentive | 138.00 + 27.50 | 17.10 | 1112 |
| | 22.50 | 18.50 | Normal | 152.35 + 30.35 [2/] | 17.50 | 1138 |
| | 22.50 | 14.00 | Incentive | 152.35 + 30.35 | 32.30 | 2100 |
| PR RUPERT (I) (Aspen) | 23.25 | 18.50 | Normal | 138.00 + 27.50 | 1.20 | 78 |
| | 23.25 | 14.00 | Incentive | 138.00 + 27.50 | 16.00 | 1040 |
| | 23.25 | 18.50 | Normal | 152.35 + 30.35 | 16.40 | 1066 |
| | 23.25 | 14.00 | Incentive | 152.35 + 30.35 | 31.20 | 2028 |
| SOUTH COAST (Alder) | 39.30 | 18.50 | Normal | 175.00 + 27.50 | 14.50 | 943 |
| | 39.30 | 18.50 | Normal | 138.00 + 27.50 | -22.50 | n.a. |
| | 39.30 | 14.00 | Normal | 138.00 + 27.50 | -11.45 | n.a. |
| | 39.30 | 18.50 | Normal | 152.35 + 30.35 | - 7.30 | n.a. |
| | 25.50 | 18.50 | Normal | 175.00 + 27.50 | 34.85 | 2265 |
| | 25.50 | 18.50 | Normal | 138.00 + 27.50 | - 2.15 | n.a. |
| | 25.50 | 14.00 | Normal | 138.00 + 27.50 | 8.90 | 578 |
| | 25.50 | 18.50 | Normal | 152.35 + 30.35 | 13.05 | 848 |

1. The selling value of the lumber plus the chip value generated as a by-product.

2. Assumes a real price increase of 2% per annum for 5 years for these two products.

Inventory information on alder is not readily available, but inventory estimates by Forgis Consultants based on Inventory Branch data indicate some 3.5 million m3 of mature alder (80 years +) is available on the South Coast. The real potential, however, is in older immature stands which are estimated to have some 7.5 million m3 in pure stands and up to 4 times that amount in mixed stands.

## OPPORTUNITIES FOR SLICED VENEER

Sliced veneer is producible from a wide variety of both hardwoods and softwoods on a global basis. The process for production starts with the selection of suitable logs or cants, production of "flitches" (machined wood pieces with grain alignment appropriate to the desired production specification), hot water conditioning of the flitches, followed by horizontal or vertical slicing of veneer in thickness ranges from 0.5 to 2.0 mm and lengths of from 1.5 to 5 m. After slicing, veneer is dried, then stacked sequentially in order to preserve grain pattern. After stacking, veneers are trimmed for width and edge defects in a jointer, then edge matched on a splicer and end trimmed on a guillotine. Finished veneer is then measured for area, shrink-wrapped and either inventoried or shipped to market.

Sliced veneer from B.C. softwoods would fall into two categories of end use. 1) Decorative wall panelling or case goods insert sections: cedar, pine and possibly cypress veneer would be overlaid to a lower quality substrate. 2) Mouldings, doors and slat products: Clear fine grained Douglas fir, hemlock and possibly yellow cedar are specialty overlaid to passage doors, door frames, window frame/sash stock and other slat products (e.g. venetian blinds) that have been produced using low-grade finger jointed stock. The resultant end product is decorative in nature and designed to give the final product the appearance of having been manufactured from solid clear stock.

### Raw Materials

Sliced veneer is producible from a wide range of both hardwoods and softwoods, however, of the residuals envisaged from B.C. forests, only knotty red cedar, knotty pine, clear Douglas fir, hemlock and cypress have established products and markets worth considering. Table 17 presents a basic specification for the two types of raw material input for a sliced veneer operation.

Sales return for sliced B.C. softwoods are indicated in Table 18.

### Capital Costs

World scale sliced veneer plants currently range in output capacity from 3,000 to 100,000 m3 annually. For purposes of this analysis, capital costs have been based on a 6,000 m3/annum output sliced veneer plant, at the rated capacity of a single slicer of 5 m length. Capital costs have been extracted from the consultant's files for equipment and buildings, however, land cost has not been included. A plant of this size is estimated to have a capital cost of $12.7 million.

Table 17. Raw Material Specification - Sliced Veneer

| | |
|---|---|
| Type of Furnish: | Roundwood<br>Pre-sawn cants |
| Species: | Red cedar<br>Lodgepole pine<br>Douglas fir - clear and fine grained<br>Western hemlock - clear and fine grained<br>Yellow cedar |
| Log Length: | Multiples of 2.5 m |
| Log Diameter: | Minimum 30 cm top DIB<br>Maximum 120 cm butt |
| Conformation: | Cedar ) Round, sound with no major<br>Pine ) defects. Maximum 2.5 cm<br>Yellow cedar) knots visible on flitch<br><br>Hemlock ) Minimum 40% of log volume<br>Fir ) recoverable to clear flitches |

Table 18. Net Mill Returns (1989) for Sliced Veneer

| PRODUCT | NET MILL RETURN $US/MSF 1/30" basis | NET MILL RETURN $CDN/m3 |
|---|---|---|
| Knotty Cedar | 42.00 | 698.00 |
| Knotty Pine | 40.00 | 665.00 |
| Clear Hemlock | 43.00 | 714.00 |
| Clear Douglas Fir | 45.00 | 748.00 |
| Cypress | 42.00 | 698.00 |
| Mix: Cedar/Pine (50:50) | | 681.50 |
| Hem-Fir-Cyp (1/3-1/3-1/3) | | 720.00 |

## Raw Materials Balance

About 12,000 m3 of sound logs of the quality specified are needed to produce 6,000 m3 of finished sliced veneer product.

## Operating Costs and Returns

All costs were considered on a 1989 B.C. basis. Net mill returns were considered on the basis shown in Table 18. Net returns to sliced veneer do not appear to be increasing and are relatively stable. For this reason any real price increase in the near future for this product were not considered.

## Sliced Veneer Feasibility

A variety of cases for this product are summarized in Table 19. This quality product was considered because current stands being harvested and even decadent stands have a small component of quality logs that could be separated and directed to this higher value-added product. For this reason wood input prices were used that equaled or exceeded average log input prices.

Tests for this product indicate net returns are not very sensitive to log input prices, and that relatively high prices could be paid for the logs. On the other hand the manufacture of sliced veneer is sensitive to utility costs and very sensitive to labour rates. No cases were seen to be feasible with high labour rates but most cases were feasible with moderate labour costs. Excellent returns were indicated for the combination of high wood costs, moderate labour costs and incentive utilities.

Table 19. Summary Table - Manufacturing Sliced Veneer

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS | 31.55 | 18.50 | Normal | 698.00 | -39.95 | n.a. |
| (Knotty cedar) | 31.55 | 14.00 | Normal | 698.00 | 42.85 | 257 |
| | 25.25 | 18.50 | Normal | 698.00 | -27.65 | n.a. |
| | 25.25 | 14.00 | Normal | 698.00 | 55.15 | 331 |
| | 25.25 | 18.50 | Incentive | 698.00 | - 8.60 | n.a. |
| KAMLOOPS | 34.50 | 18.50 | Normal | 665.00 | -78.70 | n.a. |
| (Knotty pine) | 34.50 | 14.00 | Normal | 665.00 | 4.10 | 25 |
| | 27.65 | 18.50 | Normal | 665.00 | -65.35 | n.a. |
| | 27.65 | 14.00 | Normal | 665.00 | 17.50 | 105 |
| CARIBOO | 32.40 | 14.00 | Normal | 665.00 | 8.20 | 49 |
| (Knotty pine) | 25.90 | 14.00 | Normal | 665.00 | 20.90 | 125 |
| | 25.90 | 18.50 | Incentive | 665.00 | -42.85 | n.a. |
| NELSON | 33.45 | 14.00 | Normal | 698.00 | 39.15 | 235 |
| (Knotty cedar) | 33.45 | 14.00 | Incentive | 698.00 | 58.25 | 350 |
| | 26.75 | 14.00 | Normal | 698.00 | 52.25 | 314 |
| | 26.75 | 14.00 | Incentive | 698.00 | 71.30 | 428 |
| SOUTH COAST | 39.30 | 14.00 | Normal | 720.00 | 49.70 | 298 |
| (Hem-Fir-Cyp) | 39.30 | 18.50 | Incentive | 720.00 | -14.00 | n.a. |
| | 49.15 | 14.00 | Normal | 720.00 | 30.50 | 183 |
| SOUTH COAST | 39.30 | 14.00 | Normal | 714.00 | 43.75 | 263 |
| (Clear Hemlock) | 39.30 | 18.50 | Incentive | 714.00 | -20.00 | n.a. |
| | 49.15 | 14.00 | Normal | 714.00 | 24.50 | 147 |

## OPPORTUNITIES FOR SMALL LOG SAWMILLING

Softwood lumber producible from SPF smallwood in the 5.0 to 10.0 cm top DIB range would consist of 1" and 2" dimensional lumber, suitable for use as studs, framing, battens, etc., in the general softwood consuming markets.

Sawing of this smallwood timber could be realized as an "add on" to an existing mill, thereby utilizing existing facilities and capacity. Because of barking restrictions, a new debarker would have to be installed to handle smallwood extracted and conveyed from the existing log input decks. Debarked logs would then feed to a slasher deck, then to a simple chip-N-saw mill, with outfeed to an automatic stacking system, with residuals being fed back into the mill's existing systems.

### Raw Materials

Table 20. Raw Material Specification - Small Log Sawmilling

| | |
|---|---|
| Type of Furnish: | Roundwood |
| Species: | SPF |
| Diameter: | Minimum 5 cm top DIB<br>Maximum 20 cm butt |
| Length: | Minimum 1.5 m<br>Maximum 5.0 m |
| Quality: | Free of visible defect<br>Round, sound |

### Markets

Markets for output product would fall into the general category of softwood dimension lumber, commodity product. The total market for Canadian Softwood lumber in 1988 exceeded 65 billion m3, of which up to 13 billion m3 would have been within the dimension range producible from the smallwood diameter ranges.

Late 1989 sales returns for softwood lumber and expected proportion mix are shown in Table 21.

Table 21. Net Mill Return (1989) for Softwood Dimension Lumber

| SIZE & GRADE (Green) | NET MILL RETURN $CDN/m3 | PROPORTION OF OUTPUT Percent | CONTRIBUTION $CDN/m3 |
|---|---|---|---|
| 1 x 4 Utility & Btr. | 83.00 | 50 | 41.50 |
| 2 x 4 Std. & Btr. | 107.00 | 35 | 37.45 |
| 2 x 4 Utility | 65.00 | 15 | 9.75 |
| Average Mix | | | 88.70/m3 |

## Capital Cost

For a mill of output capacity of 50,000 m3/annum (21,300 MMFBM) capital costs have been estimated at $4.1 million. It is emphasized that this milling capacity has been assumed as an addition to an existing mill, and that all basic infrastructures including land, roadways, primary and secondary power, fuels, water and sewer systems, raw material handling and residual handling systems are in place.

## Raw Materials Balance

Approximately 96,000 m3 of small sound Spruce-Fir-Pine logs would be needed to produce 50,000 m3 of saleable lumber. In addition, some 34,000 m3 of pulpchips would be produced as a by-product.

## Operating Costs and Returns

It is re-emphasized that as an addition to an existing sawmill, it is assumed that the major portion of overhead costs have been absorbed by the mill's existing operation, and only those costs directly associated with the addition have been estimated and included with operating costs.

Lumber returns were considered as in Table 21. A further real price increase scenario of $97.95/m3 was also considered. The net return for pulpchips was $33/m3 for Nelson and Kamloops, $36/m3 for the Cariboo and $32/m3 for Prince George and Prince Rupert Interior. A further real price increase of $3/m3 was then considered for the above chip prices.

## Small Log Sawmilling Feasibility

Table 22 indicates that small log sawmilling is quite feasible in the Interior under current conditions. Even with all factors at the highest costs tested, substantial returns were noted. If scarcity prices developed for sawn wood or pulpchips, substantial net returns would be available. Serious consideration should be given to using as much smallwood as possible in this type of manufacture unless profitable higher value added alternatives are available. Small log sawmilling produces more value added than a chipping plant, but less than a board plant. The latter, however, is only feasible under some specific conditions.

Table 22. Summary Table - Small Log Sawmilling

| REGION | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS | 27.65 | 18.50 | Normal | 88.70 + 33.00 [1/] | 16.10 | 1352 |
| | 27.65 | 18.50 | Normal | 97.95 + 36.00 [2/] | 27.40 | 2302 |
| | 25.45 | 18.50 | Normal | 88.70 + 33.00 | 20.30 | 1705 |
| NELSON | 26.75 | 18.50 | Normal | 88.70 + 33.00 | 17.80 | 1495 |
| | 26.75 | 18.50 | Normal | 97.95 + 36.00 | 29.15 | 2449 |
| | 24.60 | 18.50 | Normal | 88.70 + 33.00 | 21.95 | 1844 |
| CARIBOO | 25.90 | 18.50 | Normal | 88.70 + 36.00 | 21.50 | 1806 |
| | 25.90 | 18.50 | Normal | 97.95 + 39.00 | 32.85 | 2759 |
| | 23.85 | 18.50 | Normal | 88.70 + 36.00 | 25.45 | 1844 |
| PR GEORGE | 30.35 | 18.50 | Normal | 88.70 + 32.00 | 10.20 | 867 |
| | 30.35 | 18.50 | Normal | 97.95 + 35.00 | 21.50 | 1806 |
| | 27.90 | 18.50 | Normal | 88.80 + 32.00 | 14.90 | 1252 |
| PR RUPERT(I) | 31.40 | 18,50 | Normal | 88.70 + 32.00 | 8.20 | 689 |
| | 31.40 | 18.50 | Normal | 97.95 + 35.00 | 19.50 | 1638 |
| | 28.90 | 18.50 | Normal | 88.70 + 32.00 | 13.00 | 1092 |

1. The selling value of the lumber plus the chip value generated as a by-product.

2. Assumes a real price increase of 2% per annum for 5 years for lumber and a chip price increase based on a regional forecast.

## OPPORTUNITIES FOR PULPWOOD

The pulp industry of British Columbia is a large consumer of wood fibre as produced in either roundwood or chip form for delivery to the pulp mills. At present, pulp mills are geographically located in most areas of the province to permit the flow and utilization of chips produced either as residuals from primary producing plants, or from plants specifically designed and positioned to produce pulp chips for shipment to the consumer mills.

A chip production facility could be located in most general areas of the province, provided that it is located on rail in order to permit shipment of the chip product to the mills.

A chipping facility could utilize forest residuals of a wide variety, ranging from large broken pieces of trunk, to decadent standing round, to unutilized smallwood (i.e. less than 10 cm top DIB), and could include hardwood, provided the chipping plant was in reasonable proximity to a pulp mill configured to produce hardwood pulp.

Wood residual could be delivered in log form or in smaller pieces by dump truck (sheared or bucked landing debris) which would empty onto a vibrating conveyer, which would then feed to a drum debarker. The drum debarker would outfeed debarked wood to a chipper, and bark residues to a waste burner (or for hog fuel sale). Chips would be screened, then blown either directly to rail cars or to interim storage.

### Raw Materials

Table 23. Raw Material Specification for Pulpwood

| | |
|---|---|
| Type of Furnish: | Pieces, decadent roundwood, un-utilized smallwood |
| Species: | SPF, Hemlock, Fir, Aspen<br>Note: Must be species separated or grouped. |
| Diameters: | Minimum 5 cm top DIB |
| Length: | Minimum 1.5 m<br>Maximum 5.0 m |

### Markets and Returns

Markets for pulp chips for coastal B.C. appear attractive as the Region currently is in a deficit position and imports chips. Similarly, chip export prices are sufficiently attractive (high) that the general trend is still one of importing chips from the Interior for both domestic coast consumption and export.

In the Interior the situation is less clear and more attention to location and transportation with respect to markets would be necessary. Careful attention would have to be given to establishing a facility in the Kamloops or Nelson Regions as these regions currently produce more chips as a by-product of sawmilling than they can consume.

For the purposes of this study it is proposed that a chip processing plant of 400,000 m3 annually of output capacity would be feasible. This would represent about 25 percent of the annual need of a medium size pulpmill.

Net mill sales for pulp chips will depend on mill location and species.

Table 24 shows indicative late 1989 prices based on current manufacturing locations in each region.

Table 24. B.C. Pulp Chip Prices at Point of Manufacture, by Region

| REGION AND SPECIES | | PRICE ($/m3)[1] (late 1989) |
|---|---|---|
| B.C. Coast | Hembal | 42.00 |
| | Douglas fir | 38.00 |
| | Alder[2] | 27.50 - 34.00 |
| Pr. Rupert (I) | SPF | 32.00 - 33.00 |
| | Hembal | 33.00 |
| Pr George | SPF | 32.00 |
| | Aspen[3] | 27.50 - 30.00 |
| Cariboo | SPF | 34.00 - 36.00 |
| Nelson | SPF | 32.00 - 33.00 |
| Kamloops | SPF | 32.00 - 33.00 |

1. To convert to "Bone Dry Units" multiply by 2.69 for Hembal, 2.70 for SPF, 2.55 for D. fir and 2.80 for alder or aspen.

2. Limited sales; estimated current price at Coast chipping plant

3. Estimated; no current market.

## Raw Materials Balance

A plant of the capacity specified would need approximately 494,000 m3 of log input to produce 400,000 m3 of chips.

## Capital and Operating Costs

The estimated capital cost of a 400,000 m3 output chipping facility at 1989 B.C. costs is estimated to be $4.87 million, not including land costs. The site would be fully serviced by road, rail and utilities. Note that this would be an entirely new facility, specifically designed to handle small logs or pieces of wood, or low quality logs from decadent stands.

Operation of this facility would be expected to be significantly higher in cost than operating current facilities found at sawmills. In addition to more sophisticated materials handling, careful attention must be paid to screening as more decay must be removed as well as knots. As the proportion of knots increase with the use of small or decadent wood, extra costs must be incurred to remove this material as they are technically not acceptable under current or foreseeable standards.

In general, a stand alone chipping facility as described above is expected to have an operating cost of around $10/m3 with a chipping loss (cubic metres of logs in versus cubic metres of chips out) of 20 percent, while a normal facility currently operating in conjunction with a sawmill when chipping marginal sawlogs has an operating cost of around $8/m3 and a chip loss of around 10 percent.

## Chipping Plant Feasibility

The expected returns to chipping are shown in Table 25. Chipping is sensitive to wood cost but not very sensitive to either the labour rate or the cost of utilities. Also, in this situation the offered price for chips is very important. Any serious consideration to establish a chipping plant of the type described should involve a serious and thorough study of the supply and demand for pulp chips and the expected prices for the next several years.

While chipping smallwood in the Kamloops or Nelson regions does not appear attractive, chipping decadent wood appears to be feasible if the stand contains some sawlogs as well as pulpwood. If sorting occurs and the pulpwood is priced lower than the extraction cost, then chipping appears feasible. If offered prices for chips were to increase the situation would be even more attractive.

Chipping smallwood in other Regions of the Interior appears relatively unattractive; particularly in comparison to joint small log sawing plus chipping. Chipping decadent hembal in the western portion of the Prince Rupert Interior Region appears to be approaching feasibility if sorting for pulpwood occurs. Similarly, if chip prices increase the situation is more

attractive. A higher market price for chips from this region may be highly likely as the transfer cost of about $8/m3 to the Coast opens up coastal, if not world, markets that are likely to provide prices in excess of the transfer cost. Most coastal chipping situations do not appear as attractive relatively, due mainly to high wood costs. However, chipping appears feasible in some situations if wood can be obtained at marginal sawlog prices and chip prices advance past current levels.

In the case of alder and aspen the two most important variables are again the cost of wood and the price of chips. Also, chipping costs are lower than the previous situations as the material being chipped will not be particularly small or decadent. Whole log chipping of these species appears feasible if chip prices increase or if the input logs can be obtained at "pulpwood" prices (i.e. woods-run logs are sorted and the relatively smaller or lower quality logs are directed to chipping or pulp chips). Note that producing lumber and chips was attractive at current costs and prices. This supports the premise that sawing is very attractive at average extraction costs (logging costs) and chipping is not. If, however, the extracted wood is sorted into a higher value component (sawlogs) and a lower value component (pulplogs), production of both products becomes feasible. In this situation the net return to sawmilling has been decreased but the return to chipping increases. This is a classic example of how a market mechanism can support improved utilization.

Table 25. Summary Table - Pulpwood Chipping Plant

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS | 27.65 | 18.50 | Normal | 32.00 | -10.40 | n.a. |
| (Smallwood) | 23.50 | 14.00 | Incentive | 32.00 | - 4.85 | n.a. |
| | 23.50 | 14.00 | Incentive | 36.00[1] | - 0.85 | n.a. |
| | 23.50 | 18.50 | Normal | 32.00 | - 5.30 | n.a. |
| NELSON | 26.75 | 18.50 | Normal | 32.00 | - 9.30 | n.a. |
| (Smallwood) | 22.75 | 14.00 | Incentive | 32.00 | - 3.90 | n.a. |
| | 22.75 | 14.00 | Incentive | 36.00[1] | 0.10 | 40 |
| | 22.75 | 18.50 | Normal | 32.00 | - 3.35 | n.a. |
| KAMLOOPS or | 25.25 | 18.50 | Normal | 34.00[2] | - 5.45 | n.a. |
| NELSON | 25.25 | 14.00 | Incentive | 34.00 | - 5.00 | n.a. |
| (Decadent) | 25.25 | 18.50 | Normal | 38.00[1/2] | - 1.45 | n.a. |
| | 18.95 | 18.50 | Normal | 34.00 | 2.35 | 940 |
| | 18.95 | 14.00 | Incentive | 34.00 | 2.80 | 1120 |
| | 18.95 | 14.00 | Incentive | 38.00 | 6.80 | 2720 |
| CARIBOO | 25.90 | 18.50 | Normal | 34.00 | - 6.25 | n.a. |
| (Smallwood) | 25.90 | 14.00 | Incentive | 39.00[1] | - 0.80 | n.a. |
| | 22.00 | 14.00 | Incentive | 34.00 | - 1.00 | n.a. |
| | 22.00 | 14.00 | Incentive | 39.00 | 4.00 | 1600 |
| PR GEORGE | 30.35 | 18.50 | Normal | 32.00 | -13.75 | n.a. |
| (Smallwood) | 30.35 | 14.00 | Incentive | 35.00[1] | -10.30 | n.a. |
| | 25.80 | 14.00 | Incentive | 32.00 | - 7.70 | n.a. |
| | 25.80 | 14.00 | Incentive | 35.00 | - 4.70 | n.a. |
| | 25.80 | 18.50 | Normal | 32.00 | - 8.15 | n.a. |
| PR RUPERT (I) | 31.40 | 18.50 | Normal | 33.00 | -16.05 | n.a. |
| (Smallwood) | 31.40 | 14.00 | Incentive | 35.00[1] | -11.60 | n.a. |
| | 26.70 | 14.00 | Incentive | 33.00 | - 9.80 | n.a. |
| | 26.70 | 14.00 | Incentive | 35.00 | - 5.80 | n.a. |
| | 26.70 | 18.50 | Normal | 33.00 | -10.25 | n.a. |
| PR RUPERT (I) | 27.50 | 18.50 | Normal | 33.00 | - 9.25 | n.a. |
| (Decadent) | 27.50 | 14.00 | Incentive | 33.00 | - 8.80 | n.a. |
| | 27.50 | 18.50 | Normal | 37.00[1] | - 6.23 | n.a. |
| | 20.60 | 18.50 | Normal | 33.00 | - 0.70 | n.a. |
| | 20.60 | 14.00 | Incentive | 33.00 | - 0.25 | n.a. |
| | 20.60 | 14.00 | Incentive | 37.00 | 3.75 | 1500 |
| NORTH COAST | 43.65 | 18.50 | Normal | 42.00 | -20.15 | n.a. |
| (Decadent) | 43.65 | 14.00 | Incentive | 48.50[1] | -13.20 | n.a. |
| | 32.75 | 18.50 | Normal | 42.00 | - 6.70 | n.a. |
| | 32.75 | 14.00 | Incentive | 48.50 | 0.25 | 100 |

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| MID COAST (Decadent) | 42.70 | 18.50 | Normal | 42.00 | -19.00 | n.a. |
| | 42.70 | 14.00 | Incentive | 48.50[1] | -12.05 | n.a. |
| | 32.00 | 18.50 | Normal | 42.00 | - 5.80 | n.a. |
| | 32.00 | 14.00 | Incentive | 48.50 | 1.15 | 460 |
| MID COAST (Smallwood) | 50.60 | 18.50 | Normal | 42.00 | -28.75 | n.a. |
| | 50.60 | 14.00 | Incentive | 48.50[1] | -21.80 | n.a. |
| | 37.95 | 18.50 | Normal | 42.00 | -13.15 | n.a. |
| | 37.95 | 14.00 | Incentive | 48.50 | - 6.20 | n.a. |
| SOUTH COAST (Decadent) | 40.25 | 18.50 | Normal | 42.00 | -16.00 | n.a. |
| | 40.25 | 14.00 | Incentive | 48.50[1] | - 9.00 | n.a. |
| | 30.20 | 18.50 | Normal | 42.00 | - 3.55 | n.a. |
| | 30.20 | 14.00 | Incentive | 48.50 | 3.40 | 1360 |
| SOUTH COAST (Smallwood) | 39.30 | 18.50 | Normal | 42.00 | -14.80 | n.a. |
| | 39.30 | 14.00 | Incentive | 48.50[1] | - 7.85 | n.a. |
| | 29.50 | 18.50 | Normal | 42.00 | - 2.70 | n.a. |
| | 29.50 | 14.00 | Incentive | 48.50 | 4.25 | 1700 |
| SOUTH COAST (Alder) | 25.50 | 18.50 | Normal | 34.00 | - 3.75 | n.a. |
| | 25.50 | 14.00 | Normal | 34.00 | - 3.50 | n.a. |
| | 25.50 | 18.50 | Normal | 37.50[1] | - 0.25 | n.a. |
| | 25.50 | 14.00 | Normal | 37.50 | 0.00 | n.a. |
| PR GEORGE (Aspen) | 22.00 | 18.50 | Normal | 30.00 | - 3.45 | n.a. |
| | 22.00 | 14.00 | Normal | 30.00 | - 3.15 | n.a. |
| | 22.00 | 18.50 | Normal | 33.10 | - 0.35 | n.a. |
| | 22.00 | 14.00 | Normal | 33.10 | - 0.05 | n.a. |

1. Chip value at 1992-93 forecast price (f.o.b. regional point of manufacture).

2. A $2.00 premium is included for hemlock chips.

## SAWING DECADENT HEMLOCK

Hemlock cants, dimension lumber and re-manufacturing components may be produced from over-mature decadent material, provided that relatively sound pieces can be delivered to an appropriate sawmill site, then processed using relatively conventional breakdown and recovery equipment with non-sawable portions recovered as pulp chips. Non-usable components would likely have to be incinerated, but power generation under B.C. Hydro's new policies of cogeneration or small private generation may be feasible.

### Raw Materials

Table 26. Raw Material Specification for Hemlock Sawnwood

| | |
|---|---|
| Type of Furnish: | Roundwood |
| Species: | Hemlock |
| Diameter: | Minimum 30 cm top DIB<br>Maximum 1.2 m butt |
| Length: | Minimum 1.5 m pieces<br>Maximum 20 m |
| Quality: | Solid pieces but may contain some rot |

Sales returns for hemlock lumber and expected proportion mix are shown in Table 27. The "high Mix" is believed to be applicable to stands on the Mid and South Coast, and for Prince Rupert Interior. The "Low Mix" is believed to be applicable to stands on the North Coast and stands in the Kamloops and Nelson Regions. Pulp chip prices are based on Table 24.

### Capital Cost

For a mill of output capacity of 120,000 m3/annum (50.88 MMFBM), capital costs have been estimated at $19.1 million. These costs are for a hypothetical site within the target region, assuming all basic infrastructure including land, roadways, rail and/or ocean shipment facilities, etc., are available and in place.

### Raw Materials Balance

Some 311,000 m3 of wood input is estimated to be necessary to produce 120,000 m3 of saleable lumber and 127,000 m3 of pulp chips.

Table 27. Net Mill Return (1989) for Hemlock Lumber

| GRADE | NET MILL RETURN $CDN/m3 | PROPORTION OF OUTPUT Percent | | CONTRIBUTION $CDN/m3 | |
|---|---|---|---|---|---|
| | | High Mix | Low Mix | High Mix | Low Mix |
| Clears | 263.13 | 7 | 8 | 18.42 | 21.05 |
| #2 & Btr. | 123.58 | 56 | 29 | 69.20 | 35.84 |
| #3 | 69.93 | 31 | 39 | 21.68 | 27.27 |
| Economy | 39.90 | 6 | 24 | 2.39 | 9.58 |
| Average Mix | | | | 111.70 | 93.75 |

SOURCE: Mix calculated on the basis of data from Dobie & Kasper, 1975, and Dobie, et al. 1970.

## Operating Costs and Returns

Operating costs are at 1989 British Columbia rates. Mill returns are estimated as per Table 27. In addition to the recovery shown in the table, a further 20 percent loss was used to estimate a decadent component that could not be recovered in saleable product. As recent data on recovery and grade of lumber from decadent stands are not available a high mix and a low mix scenario was used on a best estimate basis. This may or may not be applicable and should a facility be considered, actual tests should be done to determine lumber recovery in relation to visible defect. As lumber and pulp chips are liable to react to real scarcity with price increases, a price increase scenario was also tested.

## Feasibility of Sawing Decadent Hemlock

Table 28 indicates opportunities where the sawing of decadent hemlock for the production of lumber and pulp chips may be feasible. The best opportunities appear to be in the Prince Rupert Interior Region and to a lesser degree in the southern Interior. Tests should be conducted in both Regions to confirm recovery but the margins as estimated do indicate a good potential. Sawing decadent hemlock is moderately sensitive to labour rates and to utilities and taxes, as well as product prices. It is moderate to high in sensitivity to wood costs. For this reason Coastal situations are not as attractive as Interior situations. They do appear feasible, however, for the Mid and South Coast if price increases are anticipated.

As large volumes of decadent hemlock are available in scattered locations on the South and Mid Coast it would appear worthwhile to initiate further investigation if the demand for hemlock lumber and pulp chips increases.

Table 28. Summary Table - Sawing Decadent Hemlock

| REGION AND TYPE OF WOOD | WOOD COST | LABOUR RATE | UTILITIES & TAXES | EXPECTED NET SELLING VALUE | NET REVENUE | ANNUAL REVENUE |
|---|---|---|---|---|---|---|
| | $/m3 | $/hr | (See terms) | $/m3 | $/m3 | $000's |
| KAMLOOPS and NELSON | 25.25 | 18.50 | Normal | 93.75 + 35.00[2] | 2.05 | 506 |
| | 25.25 | 18.50 | Normal | 103.50 + 38.00[1] | 14.80 | 3656 |
| | 25.25 | 14.00 | Incentive | 93.75 + 35.00 | 9.75 | 2408 |
| | 25.25 | 14.00 | Incentive | 103.50 + 38.00 | 22.50 | 5557 |
| PR RUPERT (I) | 27.50 | 18.50 | Normal | 111.70 + 33.00[1] | 12.15 | 3001 |
| | 27.50 | 18.50 | Normal | 123.35 + 37.00[1] | 27.80 | 6867 |
| | 27.50 | 14.00 | Incentive | 111.70 + 33.00 | 19.90 | 4815 |
| | 27.50 | 14.00 | Incentive | 123.35 + 37.00 | 35.55 | 8781 |
| NORTH COAST | 43.65 | 18.50 | Normal | 93.75 + 42.00[1] | -38.60 | n.a. |
| | 43.65 | 18.50 | Normal | 103.50 + 48.00[1] | -22.35 | n.a. |
| | 43.65 | 14.00 | Incentive | 93.75 + 42.00 | -30.90 | n.a. |
| | 43.65 | 14.00 | Incentive | 103.50 + 48.50 | -14.65 | n.a. |
| MID COAST | 42.70 | 18.50 | Normal | 111.70 + 42.00[1] | -18.20 | n.a. |
| | 42.70 | 18.50 | Normal | 123.35 + 48.50[1] | - 0.05 | n.a. |
| | 42.70 | 14.00 | Incentive | 111.70 + 42.00 | -10.45 | n.a. |
| | 42.70 | 14.00 | Incentive | 123.35 + 48.50 | 7.65 | 1890 |
| SOUTH COAST | 40.25 | 18.50 | Normal | 111.70 + 42.00[1] | -11.85 | n.a. |
| | 40.25 | 18.50 | Normal | 123.35 + 48.50[1] | 6.30 | 1556 |
| | 40.25 | 14.00 | Incentive | 111.70 + 42.00 | - 4.15 | n.a. |
| | 40.25 | 14.00 | Incentive | 123.35 + 48.50 | 14.00 | 3458 |

1. Lumber price forecast to rise 2% real for 5 years. Pulp chips at 1992-93 forecast prices, f.o.b. point of manufacture.

2. A $2.00 premium is included for hemlock chips.

## 4. INCREASED FIBRE UTILIZATION (PULP)

### OUTLOOK

Crucial to the perception of whether or not there is a realistic opportunity to increase the use of logging residuals and decadent timber stands in B.C. is a clear understanding of the long term trend in supply/demand balance for wood fibre in the province. It is also necessary to consider whether or not growth is occurring naturally (already in a well understood trend), or must be created (e.g. development of new or improved processes and markets). Finally, the economic and technical limitations that must be applied to the potential use of this fibre resource must be understood.

The task of exploring what opportunities may exist to use or increase use of logging waste and decadent timber stands involves the following:

- Review of estimated availability of usable wood from logging waste and decadent stands of timber
- Explore the trend in supply and demand for fibre by the pulp and paper industry and develop a price outlook which will include both internal and external factors affecting price
- Review the process and product limitations of currently operating (or building planned) pulp and paper mills relative to the current supply of fibre, and their possible effect on the development and use of marginal timber
- Determine the probable delivered cost of this wood using derived logging costs for various types of fibre, together with estimated conversion and additional delivery costs
- Estimate what portion of this material can be economically used within the framework of the products made by the pulping processes in existing or planned mills
- Discuss proposals for the use of material that falls outside the range of potential use by existing or planned mills.

### VOLUME AVAILABLE

Tables 3 and 4 provide estimates of the fibre that may be extracted from both private and public lands in B.C., given the current annual allowable cut with an estimated potential for increased utilization. The principal caveat to using these numbers is the impact of any environmentally driven legislation or other act of government that reduces the number of hectares in the commercial forest management base - both private and public.

Additionally, the demand by environmental groups for the removal of timbered hectares of land frequently involves those with a higher than average volume and value. There is some risk that these estimated volumes may be reduced, including the merchantable category.

In summary (and subject to the foregoing caveat) the current potential for harvesting is estimated to be:

| | |
|---|---|
| Merchantable wood | 83.4 million m3 |
| Marginal sawlogs | 3.1 |
| Fibre and pulp | 9.4 |
| Total | 95.9 |

The merchantable wood will contain some material that will fall down into pulp, especially in the logs from the old growth forests of the Coast. The marginal sawlogs (essentially sound wood) consist primarily of small tops and smaller understorey trees that have until now been considered below the size standard for use in sawmills and have been left in the logging slash. Depending on the supply/demand balance, these logs would be usable in sawmills equipped to handle this size of log and/or chip plants where they will produce a bright, high quality chip. Fibre and pulp wood is the estimated net recoverable wood from logs too small to saw that could be used by converting it into wood chips.

Not included in the annual wood supply estimate is the wood potentially available from decadent hemlock timber stands. These occur primarily in the hemlock dominated rain forests of the Coast and the southeastern Interior. They are estimated to contain some 947 million m3 of timber, of which some 515 million m3 have a high potential for recovery.

## Industrial Usage

Table 29 indicates the expected increase in the production capacity of pulp and paper mills in British Columbia from 1989 through 1992 and the increase in wood fibre requirement (5.0 million m3) to meet this capacity. The year 1992 was chosen as the trend year since the capacity expansion shown to that date is already committed.

In going out further in time (1993 to 1998), there are studies in progress to construct an additional 2.4 million tonnes of capacity requiring an increase in wood fibre supply of another 4.3 million m3.

While not all of this proposed capacity may be feasible, the risk is that a significant tonnage will be built. Of real significance in attempting to assess the outlook for the development and use of logging waste and marginal/decadent timber stands is that this potential increase much of is in the South Coast Region, which is currently in a tight wood supply situation.

Table 29. British Columbia Pulp and Paper Capacity and Fibre Usage by Year (Practical Capacity Basis, 000 tonnes)

| MILL | PROCESS | 1989 CAPACITY TONNES/YR | 1989 FIBRE M3/YR | 1990 CAPACITY TONNES/YR | 1990 FIBRE M3/YR | 1991 CAPACITY TONNES/YR | 1991 FIBRE M3/YR | 1992 CAPACITY TONNES/YR | 1992 FIBRE M3/YR |
|---|---|---|---|---|---|---|---|---|---|
| REGION I - NORTHERN INTERIOR AND NORTH COAST | | | | | | | | | |
| FCC - MCKENZIE | RMP-NEWS | 161 | 387 | 161 | 387 | 161 | 387 | 161 | 387 |
| FCC - MCKENZIE | BK | 230 | 1244 | 230 | 1244 | 230 | 1244 | 230 | 1244 |
| SKEENA - PR | BK | 422 | 2322 | 422 | 2322 | 422 | 2322 | 422 | 2322 |
| CARIBOO - QUESNEL | BK | 275 | 1539 | 335 | 1821 | 335 | 1821 | 335 | 1821 |
| LP - CHETWYN | BCTMP | | | | | 155 | 371 | 155 | 371 |
| EUROCAN - KITIMAT | UBK | 296 | 1449 | 296 | 1449 | 296 | 1449 | 296 | 1449 |
| EUROCAN - KITIMAT | UBK-SWDST38 | 230 | 38 | 230 | 38 | 230 | 38 | 230 | |
| EUROCAN - KITIMAT | CHEM-MECH | | | 113 | 271 | 113 | 271 | 113 | 271 |
| FIBRECO | BCTMP | 120 | 288 | 182 | 436 | 182 | 436 | 182 | 436 |
| INTERCON - PG | BK | 232 | 1256 | 232 | 1256 | 232 | 1256 | 232 | 1256 |
| PGP - PG | UBK/BK | 277 | 1448 | 277 | 1448 | 277 | 1448 | 277 | 1448 |
| NORTHWOOD - PG | BK | 550 | 3075 | 550 | 3075 | 550 | 3075 | 550 | 3075 |
| QRP - QUESNEL | BCTMP | 290 | 695 | 290 | 695 | 330 | 791 | 330 | 791 |
| REGION I TOTALS | | 2853 | 13703 | 3088 | 14404 | 3283 | 14871 | 3283 | 14871 |
| REGION II - SOURTHERN INTERIOR | | | | | | | | | |
| CRESTBROOK - | BK | 188 | 1026 | 188 | 1026 | 188 | 1026 | 188 | 1026 |
| CELGAR - CASTLEGAR | BK | 197 | 1071 | 197 | 1071 | 197 | 1071 | 420 | 2284 |
| WEYCO - KAMLOOPS | BK | 311 | 1742 | 311 | 1742 | 311 | 1742 | 311 | 1742 |
| WEYCO - KAMLOOPS | BK-SAWDST120 | 740 | 120 | 740 | 120 | 740 | 120 | 740 | |
| REGION II TOTALS | | 696 | 3839 | 696 | 3839 | 696 | 3839 | 919 | 5052 |
| REGION III - SOUTH COAST | | | | | | | | | |
| FCC - CROFTON | BK | 318 | 1827 | 318 | 1827 | 388 | 2229 | 388 | 2229 |
| FCC - CROFTON | BK-FINES 34 | 206 | 34 | 206 | 34 | 206 | 34 | 206 | |
| FCC - CROFTON | TMP-NEWS | 252 | 604 | 319 | 764 | 319 | 764 | 319 | 764 |
| FCC - CROFTON | GW-NEWS | 109 | 276 | 109 | 276 | 109 | 276 | 109 | 276 |
| CPFP - GOLD RIVER | BK | 238 | 1424 | 238 | 1424 | 238 | 1424 | 238 | 1424 |
| CPFP - GOLD RIVER | TMP-NEWS | | | 193 | 462 | 193 | 462 | 193 | 462 |
| HOWE SOUND | BK | 217 | 1232 | 300 | 1703 | 379 | 2151 | 379 | 2151 |
| HOWE SOUND | TMP-NEWS | | | | | 100 | 239 | 161 | 387 |
| FCC - ELK FALLS | UBK/SBK/B | 190 | 924 | 190 | 924 | 190 | 924 | 190 | 924 |
| FCC - ELK FALLS | BK-SAWDST162 | 972 | 162 | 972 | 162 | 972 | 162 | 972 | |
| FCC - ELK FALLS | TMP-NEWS | 418 | 1003 | 418 | 1003 | 451 | 1083 | 451 | 1083 |
| MB - HARMAC | BK | 360 | 2046 | 360 | 2046 | 360 | 2046 | 360 | 2046 |
| MB - POWELL R | SBK | 137 | 732 | 137 | 732 | 137 | 732 | 137 | 732 |
| MB - POWELL R | SBK-FINES50 | 305 | 50 | 305 | 50 | 305 | 50 | 305 | |
| MB - POWELL R | TMP-NEWS | 303 | 727 | 303 | 727 | 303 | 727 | 303 | 727 |
| MB - POWELL R | GW-NEWS | 192 | 484 | 192 | 484 | 192 | 484 | 192 | 484 |
| MB - ALBERNI | SBK-UBK | 175 | 935 | 175 | 935 | 175 | 935 | 175 | 935 |
| MB - ALBERNI | GW-NEWS | 242 | 611 | 202 | 522 | 202 | 522 | 202 | 522 |
| MB - ALBERNI | TMP-NEWS | 52 | 124 | 121 | 290 | 121 | 290 | 121 | 290 |
| MP - PORT ALICE | B.SULF. | 154 | 921 | 154 | 921 | 154 | 921 | 154 | 921 |
| MP - SQUAMISH | BK | 235 | 1356 | 250 | 1443 | 250 | 1443 | 250 | 1443 |
| SCOTT - NEW WEST. | GW-TISSUE | 40 | 101 | 40 | 101 | 40 | 101 | 40 | 101 |
| REGION III TOTALS | | 3632 | 15327 | 4019 | 16584 | 4301 | 17753 | 4362 | 17901 |
| TOTAL B.C. CAPACITY | | 7181 | 32869 | 7803 | 34827 | 8280 | 36463 | 8564 | 37824 |
| INCREASE IN FIBRE USAGE CAPACITY OVER 1989 | | | | | 1958 | | 3223 | | 4955 |

NOTE. SAWDUST CAPACITY OF 404 M TONNES PER YEAR AND USAGE OF 2453 M M3 USAGE OF SAWDUST IS NOT INCLUDED IN THE TOTALS. THERE ARE NO KNOWN PLANS FOR INCREASING SAWDUST CAPACITY.

Table 30 shows the production and consumption of logs and chips in three areas of the province for the year 1989 extrapolated from Statcan and trade data. The table also shows the fibre consultant's best estimate of the province's pulp fibre consumption, excluding sawdust, for the years 1992 and 1995, based on increases shown in Table 29.

In 1989 about 84 percent of the pulp fibre developed was in the form of residuals from lumber and other log processing operations, and only 16 percent from direct log usage. The indicated 1989 log harvest of close to 87 million m3 is similar to the rate of harvest for the last several years. Given current levels of utilization, and alternate forest use demands, concerns are being expressed that this rate cannot be sustained under previously defined conditions.

Private sector indications are that the pulp and paper industry will not permit itself to run short of wood. It will log and/or buy logs from stands that have up to now been considered economically unattractive due to high logging costs and/or poor quality or undesirable species. It is also likely the industry will reconsider salvage logging to see what additional fibre can be recovered.

Using a reasonably optimistic approach it is likely that during the next five years the harvest will be maintained, but only through utilizing wood from marginal and decadent stands of timber, and by a more complete removal of usable fibre during the logging process.

Table 31 presents the situation that could be possible by 1992 as the forest products industry wrestles with the problem of developing enough wood to meet the demand for logs by the sawmills, plywood and veneer plants, shake and shingle mills and other log related businesses and for chip and roundwood fibre by the pulp and paper industry.

In this table an attempt is made to match the demand for logs, for each region, by the various sectors of the wood products industry. In spite of possible limitations in log supply, log exports have not been eliminated entirely as it is unclear what conditions may be necessary to decrease exports. Similarly an allowance has been made for the continuation of some chip exports moving under long term export contracts.

By 1992 the capacity demand for pulp fibre will have grown by 5 million m3. This would be 8 million m3 more than the actual usage in 1989 because in that year major operating problems at a number of mills reduced consumption. Significantly, Table 31 shows the shift to the increasing reliance by the pulp and paper industry on using roundwood (from 7 to 15 percent of the log harvest and from 14 to 28 percent of the wood chips production) in order to provide the volume required to meet the industry's needs. The only alternative to chipping roundwood to meet the increase in requirements would be to expand the supply of residual chips by substantially increasing the volume of logs sawn.

Under current conditions this appears unlikely, although some increase could occur if conditions changed that permitted the sawing of some decadent wood.

## Table 30. B.C. Production and Distribution of Wood Chips for 1989

(EST. 1989 BASED ON ELEVEN MONTHS YTD STATCAN AND OTHER TRADE DATA)

| REGIONS | 1 | 2 | 3 | TOTAL B.C. | |
|---|---|---|---|---|---|
| YEAR | 1989 | 1989 | 1989 | 1989 | |
| | - | BILLIONS OF FBM | - | | |
| LUMBER PRODUCTION | 7.8 | 3.3 | 4.1 | 15.2 | |
| LOG HARVEST | - | MILLIONS OF M3 | - | | % |
| SAWLOGS TO LUMBER | 36.9 | 15.1 | 21.4 | 73.4 | 84 |
| EXPORT LOGS | 1.0 | | 0.8 | 1.8 | 2 |
| PULPWOOD )))))))) | 0.6 | 0.3 | 5.4 | 6.3 | 7 |
| MISC. | 0.1 | 0.1 | 0.1 | 0.3 | 0 |
| OTHER MANUFACTURING | 1.5 | 1.4 | 2.7 | 5.6 | 6 |
| TOTAL LOG HARVEST | 40.1 | 16.9 | 30.4 | 87.4 | |
| WOOD CHIPS & GW BLKS | | | | | % |
| SAWMILLS | 12.8 | 5.5 | 8.8 | 27.1 | 79 |
| PLYMILLS | 0.4 | 0.4 | 0.4 | 1.2 | 3 |
| SHAKE & SHINGLE | | | 0.2 | 0.2 | 1 |
| CHIP MILLS-OTHER | 0.6 | 0.3 | 0.1 | 1.0 | 3 |
| CHIP MILLS-P&P | 0.1 | | 3.2 | 3.3 | 10 |
| GROUNDWOOD F.D. | | | 0.2 | 0.2 | 1 |
| UNREPORTED PRDN | | | | 0.0 | 0 |
| GW BLOCKS | | | 1.5 | 1.5 | 4 |
| TOTAL PRODUCTION | 13.9 | 6.2 | 14.4 | 34.5 | |
| IMPORTS | | | 0 | 0.0 | |
| TOTAL AVAILABLE | 13.9 | 6.2 | 14.4 | 34.5 | |
| INTER-REGIONAL TRANSFERS | -1.5 | -1.9 | 3.4 | 0.0 | |
| EXPORTS | 0.0 | -0.5 | -4.0 | -4.5 | |
| INVENTORY GAIN(LOSS) | -0.2 | 0.3 | 0.0 | 0.1 | |
| CONSUMPTION-ACTUAL | 12.6 | 3.5 | 13.8 | 29.9 | |
| CONSUMPTION-CAPACITY 1989 | 13.7 | 3.8 | 15.3 | 32.8 | |
| CONSUMPTION-CAPACITY 1992 | 14.8 | 5.1 | 17.9 | 37.8 | |
| CONSUMPTION-POSSIBLE 1995 | 18.7 | 5.1 | 18.3 | 42.1 | |

NOTE:

REGION 1. CARIBOO NORTH AND INCLUDING NORTH COAST MILLS. THESE MILLS ARE INCLUDED IN REGION 1 AS MOST OF THEIR CURRENT CHIP SUPPLY COMES FROM REGION 1.

REGION 2. KAMLOOPS/OKANAGAN/KOOTENAIS

REGION 3. SOUTH COAST

Table 31. Estimated Production and Distribution of Wood Chips and Blocks for the Years 1989 and 1992.

| REGIONS | 1 | | 2 | | 3 | | TOTAL B.C. | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | 1989 | 1992 | 1989 | 1992 | 1989 | 1992 | 1989 | | 1992 |
| | | - BILLIONS OF FBM - | | | | | | | |
| LUMBER PRODUCTION | 7.8 | 7.7 | 3.3 | 3.3 | 4.1 | 4.1 | 15.2 | | 15.1 |
| LOG HARVEST | | - MILLIONS OF M3 - | | | | | | % | % |
| SAWLOGS TO LUMBER | 36.9 | 35.1 | 15.1 | 15.3 | 21.4 | 20.5 | 73.4 | 84 | 70.9 77 |
| EXPORT LOGS | 1.0 | 0.4 | | | 0.8 | 1.0 | 1.8 | 2 | 1.4 2 |
| PULPWOOD )))))))) | 0.6 | 4.2 | 0.3 | 0.8 | 5.4 | 8.7 | 6.3 | 7 | 13.7 15 |
| MISC. | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0 | 0.3 0 |
| OTHER MANUFACTURING | 1.5 | 1.5 | 1.4 | 1.4 | 2.7 | 2.6 | 5.6 | 6 | 5.5 6 |
| TOTAL LOG HARVEST | 40.1 | 41.3 | 16.9 | 17.6 | 30.4 | 32.9 | 87.4 | | 91.8 |
| WOOD CHIPS & GW BLKS | | | | | | | | % | % |
| SAWMILLS | 12.8 | 12.5 | 5.5 | 5.5 | 8.8 | 8.1 | 27.1 | 79 | 26.1 65 |
| PLYMILLS | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 1.2 | 3 | 1.2 3 |
| SHAKE & SHINGLE | | | | | 0.2 | 0.2 | 0.2 | 1 | 0.2 0 |
| CHIP MILLS-OTHER | 0.6 | 3.3 | 0.3 | 0.3 | 0.1 | 3.2 | 1.0 | 3 | 6.8 17 |
| CHIP MILLS-P&P | 0.1 | 0.7 | | 0.5 | 3.2 | 3.2 | 3.3 | 10 | 4.4 11 |
| GROUNDWOOD F.D. | | | | | 0.2 | 0.2 | 0.2 | 1 | 0.2 0 |
| UNREPORTED PRDN | | | | | | | | 0 | 0.0 0 |
| GW BLOCKS | | | | | 1.5 | 1.5 | 1.5 | 4 | 1.5 4 |
| TOTAL PRODUCTION | 13.9 | 16.9 | 6.2 | 6.7 | 14.4 | 16.8 | 34.5 | | 40.4 |
| IMPORTS | | | | | 0 | 0 | | | 0.0 |
| TOTAL AVAILABLE | 13.9 | 16.9 | 6.2 | 6.7 | 14.4 | 16.8 | 34.5 | | 40.4 |
| INTER-REGIONAL TRANSFERS | -1.5 | -2.0 | -1.9 | -1.5 | 3.4 | 3.5 | 0.0 | | 0.0 |
| EXPORTS | 0.0 | -0.1 | -0.5 | -0.1 | -4.0 | -2.4 | -4.5 | | -2.6 |
| INVENTORY GAIN(LOSS) | -0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | | 0.0 |
| CONSUMPTION-ACTUAL | 12.6 | 14.8 | 3.5 | 5.1 | 13.8 | 17.9 | 29.9 | | 37.8 |
| CONSUMPTION-CAPACITY 1989 | 13.7 | | 3.8 | | 15.3 | | 32.8 | | |
| CONSUMPTION-CAPACITY 1992 | | 14.8 | | 5.1 | | 17.9 | | | 37.8 |
| CONSUMPTION-POSSIBLE 1995 | | 18.7 | | 5.1 | | 18.3 | | | 42.1 |

NOTE:

REGION 1. CARIBOO NORTH AND INCLUDING NORTH COAST MILLS. THESE MILLS ARE INCLUDED IN REGION 1 AS MOST OF THEIR CURRENT CHIP SUPPLY COMES FROM REGION 1.

REGION 2. KAMLOOPS/OKANAGAN/KOOTENAYS

REGION 3. SOUTH COAST

In view of the general awareness of the growing capacity demand for fibre from the pulp and paper sector, and the need to maintain the sawlog supply to the solid wood product mills, the industry is already moving in the direction of planning to utilize marginal timber. The Ministry of Forests is currently advertising four Pulpwood Agreements which will give successful bidders the opportunity to cut low grade stands, subject to demonstrating that they are unable to obtain their requirements from "normal" sources.

In Table 32 a balance is approximated in respect of the 1992 demand for the provincial log harvest, by region and end use, against the estimated sustainable recoverable supply from each region. The merchantable log supply in each region was reduced by the normal fall down of some of the wood into the pulpwood category. (The demand data in Table 31 was iterated in Table 32 in order to develop a practical fit.)

Table 32. Estimated Merchantable and Marginal Wood Potentially Available Long Term, Adjusted for Falldown to Pulpwood (000 000 m3)

| | MERCH | MARGINAL SAWLOGS | FIBRE & PULP | TOTALS | HEMBAL DOMINATED DECADENT/MARGINAL TIMBER INVENTORY | |
|---|---|---|---|---|---|---|
| | | | | | GROSS | NET |
| R1 TOTALS | 33.8 | 2.0 | 3.7 | 39.5 | 521.0 | 349.0 |
| PULPWOOD FALLDOWN | -0.7 | | 0.7 | | | |
| NET R1 AVAILABLE | 33.1 | 2.0 | 4.4 | 39.5 | | |
| 1992 DEMAND | 37.1 | | 4.2 | 41.3 | | |
| LONG/-SHORT | -4.0 | 2.0 | 0.2 | -1.8 | | |
| R2 TOTALS | 18.9 | 0.7 | 1.9 | 21.5 | 60.0 | 29.0 |
| PULPWOOD FALLDOWN | -0.4 | | 0.4 | | | |
| NET R2 AVAILABLE | 18.5 | 0.7 | 2.3 | 21.5 | | |
| 1992 DEMAND | 16.8 | | 0.8 | 17.6 | | |
| LONG/-SHORT | 1.7 | 0.7 | 1.5 | 3.9 | | |
| R3 TOTALS | 30.7 | 0.4 | 3.8 | 34.9 | 366.0 | 137.0 |
| PULPWOOD FALLDOWN | -5.4 | | 5.4 | | | |
| NET R3 AVAILABLE | 25.3 | 0.4 | 9.2 | 34.9 | | |
| 1992 DEMAND | 24.2 | | 8.7 | 32.9 | | |
| LONG/-SHORT | 1.1 | 0.4 | 0.5 | 2.0 | | |
| TOTAL B.C. | 83.4 | 3.1 | 9.4 | 95.9 | 947.0 | 515.0 |
| PULPWOOD FALLDOWN | -6.5 | 0.0 | 6.5 | 0.0 | | |
| NET AVAILABLE | 76.9 | 3.1 | 15.9 | 95.9 | | |
| TOTAL 1992 DEMAND | 78.1 | 0.0 | 13.7 | 91.8 | | |
| LONG/-SHORT | -1.2 | 3.1 | 2.2 | 4.1 | | |
| 1992-5 DEMAND | 78.1 | | 18.0 | 96.1 | | |
| LONG/-SHORT | -1.2 | 3.1 | -2.1 | -0.2 | | |

NOTE:

REGION 1 CARIBOO NORTH AND INCLUDING NORTH COAST MILLS. THESE MILLS ARE INCLUDED IN REGION 1 AS MOST OF THEIR CURRENT CHIP SUPPLY COMES FROM REGION 1 - INTERIOR

REGION 2 KAMLOOPS/OKANAGAN/KOOTENAYS

REGION 3 SOUTH COAST

There are some significant regional differences:

Region 1 - Northern Interior and North Coast

This region is characterized by an apparent shortfall in the supply of sawlogs of some 4.0 million m3. This shortfall is only reduced to 2.0 million if all the marginal sawlogs are included. Even the potentially recoverable pulp is virtually all consumed for a net regional shortfall of 1.8 million m3.

Considering the known demand against a supply that is at best a good estimate it is reasonable to expect that within a short period of time we can expect to see the industry commence to consider the use of the marginal and decadent wood in the Prince Rupert coast and interior regions. These forests are estimated to contain some 349 million m3 of recoverable wood, principally hemlock and balsam, which if developed on a fifty year removal and reforestation basis would generate an annual supply of some 7 million m3. This volume (assuming no reduction in the hectares of commercial timberland in the region) would bring the region's wood supply approximately into balance.

The potential expansion in demand for wood chips, from 1992 to 1995 (see Table 31), of an additional 3.9 million m3 suggests that maximum utilization of all available fibre in this region can be anticipated.

Region 2 - Southern Interior

This region is the only region, based on long term estimates of available supply and known and forecasted demand, that appears to be in reasonably good balance. It has intermittently supplied some chips to Region 1 and sells a large volume into Region 3 for domestic and export use. It can be anticipated that as the value of chips and pulpwood increases throughout the province, local production of chips from the hitherto unused resources of this region will be developed and move into the other regions to help satisfy demand. In fact this activity has already commenced with the construction of a chip plant at Cache Creek, utilizing low grade hemlock and balsam from the region, with the chips being moved into the coast and export market. This type of activity will likely expand.

Region 3 - South Coast

The coastal region shows a positive balance but the outlook is more uncertain. Considering its proximity to the centres of population and tourism it is more at risk (than the other areas) in so far as environmental pressures may act to reduce the number of hectares in commercial forest lands or impede the "normal" rate of logging. The availability estimates also include a significant harvest of some 8 million m3 from private timberlands - which is subject to the plans and policies of the owners. This volume is critical to balancing the supply of high quality logs to the sawmills and veneer plants on the coast.

Table 32 also shows that pulpwood in Region 3 is in relatively tight balance and only slightly better off if the small volume of recoverable marginal sawlogs are included with the pulp. As with Region 1, it seems reasonable to assume that the industry will soon consider using some of the 137 million m3 of the more readily accessible decadent hemlock the South Coast forests are estimated to contain.

On a provincial basis, given the projected harvest and recovery of the projected volume of logging waste, the province in total has only a margin of some 4 million m3. This is an uncomfortably small margin given the potential for supply curtailment by increasing alternative forest uses. Assuming that by 1995 the pulp and paper sector's demand for fibre has increased by another 4.3 million m3 (see Table 31), there will most certainly be a need for using wood from marginal timberlands.

Given the known capacities for wood use in each region and the province in total, the two major risks to the accuracy of the fibre balances the consultant has developed are:

1. The quality of the inventory and planning data upon which the forest supply estimates were made; and

2. The impact of environmental pressure on the hectares available for commercial logging and the rate of logging and conditions under which they may be logged.

Both of these factors could easily upset the available wood versus capacity balance. Moreover, it is the consensus and concern of the industry that the total merchantable harvest (estimated at 83.4 million m3 in this report) could decline to less than 80 million m3 during the remainder of this century.

The major conclusion of this section is that given the magnitude of the known and estimated future demand for wood fibre in the province relative to the estimated supply available and the significant risks involved in the supply estimate, the industry will move to develop, of its own volition, the orderly increased use of the standing timber available to it.

In B.C. the situation is one of expanding capacity with some attendant adjustments concerning supply. In the U.S. Pacific Northwest it is one of maintaining current capacity in the face of growing restrictions on cutting old growth timber. This circumstance could lead to a situation where any potential fibre not required for the domestic B.C. market may be developed for export as wood chips to the U.S. markets. Such a situation would also have the advantage of allowing a replacement of decadent stands with thrifty new forests.

## PULP CHIP PRICES

The dramatic shift that will take place in the source of fibre used in the expansion of the pulp and paper sector - the increase from using 13 percent roundwood chips to 28 percent (and much of this lower in grade) - cannot help but have a major and permanent impact on chip price levels, whether for roundwood or for residual chips. It is likely pulp mill buyers will bid up the price of residual chips (particularly hemlock and whitewood chips) in order to avoid the higher capital, operating and administrative cost associated with large scale, low grade pulpwood logging and conversion, together with the higher process cost and losses faced by the pulp mills themselves.

The fibre consultant believes that chip and pulpwood prices in the U.S. Pacific Northwest and B.C. will, in future, be driven by:

1. The timber situation in both the U.S. and Canada, and

2. The rate of expansion of the pulp and paper industry in B.C.

The only likely offsets to the foregoing are:

1. Expanded usage of recycled material, especially in U.S. linerboard mills, and

2. A forecast period of industry over-expansion temporarily leading to operating rates of around 91-93 percent of capacity, and consequently lower pulp and paper prices.

Table 30 demonstrates the rapidly increasing demand on the B.C. fibre resource. Even in 1989, capacity exceeded the supply net of exports. However, demand was reduced due to major operating problems at a number of mills and slow expansion start ups. This allowed the system to stay in balance and chip prices to stabilize - after demonstrating a rapidly rising trend throughout the year.

By 1992, the capacity of the B.C. industry will have increased by 5 million m3 of chip usage (15.1 percent) over 1989 capacity to 37.8 million and 7.6 million m3 (25.5 percent) over the maximum normal fibre supply (net of exports) available in 1989. By 1995 there is the potential for a further increase in fibre demand, by the pulp and paper mills, of 4.3 million m3 for a total increase in capacity over 1989 of 9.3 million m3.

The log harvest in 1989 was approximately 87 million m3 with about 72 million m3 going to the province's sawmills. The industry in B.C. has expressed concern that this level of harvest, especially of the grade and quality required for sawmills, is unsustainable.

This suggests that British Columbia could face a new high in chip prices from a combination of the following:

- The higher cost of removing all marginal sawlogs and pulp and fibre material during or after the normal logging process.

- The higher losses to be experienced in chipping wood from decadent stands and removing the higher percentage of rot, knots and ingrown bark seams, and in disposing of the hog fuel.

- The higher process costs and losses to be experienced in the conversion of this type of fibre at the pulpmill.

- The limitations in use of decadent wood: most kraft mills can use it but TMP market or newsprint mills will avoid it, even if it means incurring significant additional costs.

- Sawmills and plywood/veneer mills will attempt to offset their shrinking supply of sawlogs by increasing their lumber and veneer recovery. This will further exacerbate the chip supply situation - unless chip prices are raised to the level where it will no longer be attractive to invest capital to obtain higher lumber recoveries.

There are three potential offsets to the view of the industry just described:

1. The use of recycled waste is being considered and, in the case of the coastal newsprint mills, will likely move forward within the foreseeable future. However, in B.C. with a very small population to pulp and newsprint capacity ratio, the availability of domestic waste will limit its extensive use. Furthermore, there are only two large scale linerboard and bag stock mills in B.C., both remotely situated from the south coast and U.S. supply of boxboard and other waste.

   It should be noted that in the case of the newsprint mills on the coast, only legislative fiat in their marketing areas, not beneficial economics, is driving them into using recycled waste. Some of the waste will have to be imported in order for these mills to meet the mandated waste inclusion percentage in their newsprint. At most, this is estimated to reduce virgin fibre usage by about 0.6 million m3 (1.5 percent).

2. A number of forecasters, including the Canadian Pulp and Paper Association, are indicating a surplus of capacity to shipment ratio during the '90's. These sources also suggest operating rates will average 93 percent, for a domestic usage of 35.0 million m3 in 1992, as compared to a usage capacity of 37.8 million.

   Yet even at this reduced operating rate, but with the expected decline in the availability of suitable sawlogs, the use of pulpwood will increase by 82 percent, from 6.0 million m3 in 1989 to 10.9 million in 1992, just to balance demand.

3. As a result of these forecasts of capacity to shipment ratios, the same forecasting sources are also looking for lower market pulp prices. While this will inhibit overly competitive chip pricing, it will not prevent chips from reaching a new higher level, for the alternative is shortage and shutdown.

Up to this point, the developing fibre situation has been examined on the basis of the use of all grades and species of chips. Now attention is focused on the long term outlook for TMP quality chips and pulpwood. By 1992 the production of newsprint and newsprint like grades of paper and TMP market pulp will have grown to 2.7 million tonnes, requiring some 6.6 million m3 of sound, bright 70 percent hemlock fibre or 70 percent white or Engelmann spruce (with the balance being in equivalent quality Interior SPF mix).

In addition to the domestic demand, there is a strong demand for this type of fibre from the export market for the newsprint and sulphite mills of the U.S. Pacific Northwest and Japan.

Hemlock (the preferred species) and whitewood suitable for the production of TMP newsprint is already in tight supply on the B.C. coast. There is no forecast that suggests that it will become less so. In fact, with C.P.F.P. Limited's new Gold River machine coming on line in late 1989, Howe Sound Pulp and Paper's Port Mellon machine due to start up in April/May of 1991, plus incremental expansions at McMillan Bloedel and Fletcher Challenge mills, the supply situation for this type of fibre will get tighter and more competitive.

The coast TMP mills will compete in the Interior for high quality whitewood chips (a usable but less attractive species) and may have to pay the full Interior market price plus the cost of bringing this fibre down to the Coast. Alternatively, or as well, they will start competing for suitable hemlock and whitewood in the U.S. B.C. pulpmills are already buying TMP quality pulpwood in Olympia and Port Angeles and similarly, other buyers are expected to reach out for more of this quality hemlock fibre from Washington, Oregon and Alaska.

In the longer term we expect to see the demand for hemlock pulp fibre by the expanding TMP newsprint mills on the B.C. Coast driving the B.C. Coast, Puget Sound and Columbia River TMP quality chip market.

All of the foregoing strongly suggests, that given any strength in the pulp market, the B.C. pulp and paper industry will be able to consider the use of wood they have heretofore ignored by reason of cost and quality, thus making it economically and technically feasible to consider extracting at least some part of the salvageable material currently being left in the woods and in marginal and decadent timber stands.

This section on prices is best summarized by examination of the price forecast in Table 33. These forecasted average prices represent the fibre consultant's best estimate of the level of prices that will develop in the industry, on a competitive basis, in order for all segments to operate at or near capacity.

Table 33. Comparison of Historic and Estimated Future Chip Prices (Delivered per m3)

| PERIOD | B.C. COAST (HEMBAL) RESIDUAL | B.C. COAST (HEMBAL) ROUNDWOOD[1] | B.C. INTERIOR (SPF) RESIDUAL AND ROUNDWOOD |
|---|---|---|---|
| Q4/87 | $37.70 | $42.00 | $29.60 |
| Q4/88 | 43.00 | 49.00 | 35.60 |
| Q4/89 | 47.00 | 53.00 | 39.90 |
| 1992-3 est | 53.50 | 56.00 | 43.10 |
| 1995 est | 56.90 | 59.00 | 45.70 |

1. Buying marginal sawlogs or a pulpwood sort and then chipping.

The outlook for the period 1992-3 assumes the solid wood component of the forest products industry will continue to operate at close to its current rate and that, similarly, the pulp and paper group will operate close to the capacity forecasted for this period. Deviations in operating rates and sales realizations due to cyclical economic swings may temporarily skew prices away from these estimates (in 1989 dollars). However, we believe that in a short time the prices forecasted will represent the cost driven transaction levels of the industry.

## PROCESS AND PRODUCT LIMITATIONS ON FIBRE USAGE IN THE PULP AND PAPER SECTOR[1]

What are the practicalities of and limitations in using this additional lower quality fibre? There is a need to consider the technical and process constraints of each pulp mill, as well as the general pulp manufacturing processes (thermomechanical and groundwood, sulphite, bleached kraft and unbleached linerboard and bag stock) as related to the following general fibre characteristics:

1. Throughout the fibre usage section of this report, chip species will be referred to as follows:

   Douglas fir as such
   Douglas fir mix as such
   Normal hemlock/balsam (Abies species) mix as "hembal"
   Interior spruce/pine/fir (Abies species) mix as SPF
   Western red cedar as "cedar"
   Other species as such

- species/fibre characteristics
- colour/brightness
- soundness of wood/density
- geometry/chip size and shape (the range of sizes and thicknesses)
- natural contaminants (bark, knots, rot)

There is a need to take into account, not only the cost of this new source of fibre as delivered to a pulpmill, but also the impact on process costs and sales realization of using any material that is lower in quality than current industry specifications.

Each mill tends to have different specifications, depending on the mill's process and product, and on local chip availability. The divergence, however, is not great.

Chip specifications range from the slightly less onerous in the Japanese export contracts to the somewhat more complex ones of the coastal TMP mills. Tables 34 and 35 set out these specifications. Table 35 represents a reasonable composite of the chip specifications used in the B.C. pulp and paper industry.

In examining and comparing these specification tables an important caveat must be kept in mind: the Japanese export specifications (Table 34) are based on the receipt of residual chips from sawmills whereas Table 35 assumes that at least some of the chips will be produced from pulpwood and salvage wood. Residual chips from sawmills are produced from logs that are relatively knot, rot and bark seam free as compared to pulpwood generated from lower quality logs.

The principal fibre characteristics that will significantly effect the utility, limitations to its use and cost of fibre developed from salvage logging and the logging of marginal timber stands are examined below. Basic properties for species are summarized in Table 36.

## Species and Fibre Characteristics

While pulp and paper can be made from any softwood or hardwood species, variations in the fibre characteristics, density and extractives of each may limit their use depending on the mill process and the product and competitiveness of the end-use market. The fibre of each species varies from the thick cell walled Douglas fir to cedar with its relatively long thin fibres. In between are the other principal softwoods: hembal on the coast and the SPF of the Interior.

Table 34. Specifications for Chips Exported to Japan

Chips will be measured in accordance with TAPPI standards T16ts-61 using the screen size for nominal 3/4" wood chips:

| | | Percentage Content Allowed per Delivery |
|---|---|---|
| Over 1-1/2" | | Maximum 5% |
| Between 1-1/2" and 3/16" (inclusive) | | Minimum 90% |
| Under 3/16" | | Maximum 5% |
| Species: | Whitewood from the interior of B.C. consisting of spruce, lodgepole pine and balsam with traces only of other species being permitted. The chips must contain a minimum of 40% spruce. | |
| Contaminants: | The chips shall be substantially free of contaminants and other foreign material and may not contain more than: | |
| | Bark | Maximum 1% |
| | Rot | Maximum 1% |

Table 35. A Practical Composite of the Chip Specifications Used in B.C.

| WFPL CLASSIFICATION | | SPECIFICATION |
|---|---|---|
| Percent Oversize | +45 mm ) | |
| Percent Over Thick | + 1 mm ) | - 3.0 |
| Percent Acceptable | + 7 mm | +89.0 |
| Percent Pins | + 3 mm | - 7.0 |
| Percent Fines | - 3 mm | - 0.5 |
| Percent Bark | | - 1.0 |
| Percent Knots | | - 2.0 |
| Percent Rot | | - 0.25 |

Note: These specifications will not necessarily add to to 100%. They represent minimum and maximums acceptable.

Table 36. Primary Pulp and Paper Making Properties of the Principal Softwood Species of B.C.

| SPECIES | DENSITY | FIBRE PROPERTIES | EXTRACTIVES | SUITABLE FOR NEWSPRINT |
|---|---|---|---|---|
| D. fir | 425 kg/m3 | High tear<br>Low burst | High | No |
| Hembal | 400 kg/m3 | Medium tear<br>High burst | Low | Yes |
| SPF | 400 kg/m3 | Medium tear<br>High burst | High | Qualified Yes |
| Cedar | 310 kg/m3 | Low tear<br>High burst | High | No |

These characteristics give rise to the following usage limitations:

. Douglas fir

It is considered the premium species for the production of linerboard or semi-bleach pulp for use as the kraft component of newsprint due to its high tear strength. Other species can be used for semi-bleach, but will require a higher percentage to be included in the newsprint to achieve the same strength. This will increase the cost of the newsprint. Also the use of species other than fir generally means that the mill will have less pulp available to sell, thereby losing sales realization dollars. On the other hand, Douglas fir is generally considered unsuitable for the production of pulps that go into the manufacture of papers that require good writing or printing characteristics. For non-critical pulps it is used as much as possible due to its high density and volumetric yield.

. Hembal

This species mix is considered the best general purpose fibre for most grades of market pulp and paper having moderate tear, low extractives and good formation. The newspapers publishers of the West Coast and Midwest U.S. (a principal market for B.C. newsprint) prefer hemlock based newsprint to other species and basically refuse to accept species or mixes that change the characteristics of the newsprint sheet. Much work has gone into trying to stretch the limited supply of bright hemlock and it now seems that about 20-30 percent Interior SPF mix can be added without significantly changing the sheet. Density and volumetric yield of hembal is somewhat lower than D. fir.

- Interior SPF

  This species mix representing most of the chips produced in the Interior is a good general purpose fibre but is comparatively high to extractives due to the pine content. This renders it unsuitable for use in the sulphite process or where the extractives may change the characteristics of the sheet, as in newsprint. These comments do not hold true for pure Interior spruce or SPF mixtures containing 70-80 percent spruce. Pure spruce is equivalent, or even more desirable, than hemlock for some applications. SPF chips for the Japanese export market are required to contain a minimum content of spruce as it is used mostly for TMP newsprint production. Density and volumetric yield of SPF is similar to hembal.

- Cedar

  Three qualities of cedar that tend to limit its use in pulp and paper manufacture in B.C. are as follows: It is very corrosive, has a low density and low tear strength. Its corrosive quality virtually prohibits its use in other than all stainless steel mills. The use of cedar, where it cannot be avoided, will generally result in a reduced production rate in the order of the ratio of the density of cedar fibre (310 kg/m3) compared to SPF or hembal (400 kg/m3). Its low tear strength renders it unsuitable for products such as semi-bleach for newsprint. However, cedar's long thin fibre gives it very good folding and printing qualities and it is used wherever these characteristics are a prerequisite. Generally, most mills avoid its use because of the tonnage loss, and only use it because they have captive supplies or are able to acquire more desirable chips along with the cedar.

Colour and Brightness

These characteristics are generally of little consequence in the kraft process, so long as the wood is sound. However, for the TMP process the wood must be very bright to start (54 on the Elrethro scale) due to the limited response in bleaching mechanically produced fibres. Chips from mills cutting old growth hemlock generally measure in the range of 46 - 51 on the Elrethro scale. Therefore, there is a strong demand from the TMP newsprint mills on the Coast for hemlock chips from smaller, faster grown trees and second growth logs for the brightness of the wood. In the Interior, the SPF is essentially a very bright wood, while the Interior decadent hembal stands are very dark.

Soundness of Wood/Density

Old wood, while superficially sound, can have a lower yield. This can cause a reduction in mill output as well as cause quality problems. For example, assuming that a certain batch of wood has a ten percent lower density, the yield is ten percent lower. The impact on the mill (normally

digester and recovery boiler limited) is a 10 percent reduction in output and hence sales realization.

## Bark, Rot and Knots

These defects must be eliminated from the chips prior to being processed. The consequences of not doing so are quality problems and production losses. As in the case of brightness, these naturally occurring contaminants are more critical in the TMP process than the kraft. Bark, in a kraft mill, loads up the cooking liquor, generates undesirable fibre-like cells and dirt. The result is similar with rot.

Knots have a similar impact on the kraft mill where they are screened out from the cooked wood and then recirculated "until they disappear". Apart from production losses due to digester space being taken up with knots, some of the wood will char and create dirt problems. Knots also include a high percentage of extractives and usually contain ingrown bark seams. Associated with knots is compression wood which will also generate quality problems. In the TMP mill, bark and rot are ground up and come through the process as dirt and colour degradation. Knots break up into small particles referred to as "chop" and become serious quality problems.

## Chip Size

Small wood and wood from decadent stands of timber can be manufactured into chips that would meet standard chip size classification specifications.

## IMPORTANCE OF CONTAMINANT REMOVAL

Practically, bark, knots and rot have to be removed. An order of magnitude example of the cost of using wood containing a contaminant in a normal B.C. kraft pulping process is set out below:

Assuming:
- 1000 tonne/day capacity
- digester and recovery constrained
- a 1% excess contaminant such as rot

| | | | |
|---|---|---|---|
| Calculation: | Fibre loss - 1% x 1000 x 5.6 x $47/m3 | = | $2,632/day |
| | Chemicals etc. 1% x 1000 x $230/tonne | = | $2,300/day |
| | Sales realization loss (net C$) 1% x 1000 x $840/tonne | = | $8,400/day |
| | Total loss | | $13,322/day |

Modern barking equipment will remove bark to specification except in the case of excessively knotty material, logs with ingrown bark seams or hard frozen logs. During periods of extremely cold weather most pulp mills will tolerate some bark in excess of specifications but expect to receive chips containing very little bark during normal weather conditions. Very knotty pulpwood or logs with severe bark seams are unsuitable for full bleach pulp, but may be usable in linerboard mills or board plants.

Knots, which are seldom a problem in residual chips due to the grade of wood used, become a real issue when chipping pulpwood. Pulpwood is a log that is by definition not suitable for sawing and is almost certain to have been down graded due to excessive knots, rot, bark seams or other defects. This is especially true of logs from the tops of trees or from suppressed growth timber. Excessively knotty logs of this type should be avoided.

In the chipping process some knots will come through as chunks sufficiently large to be screened out as overs. It is important that as much of this material as possible be removed as it will come through the rechipping process as acceptable smaller pieces, but still knot material.

Rot embodies all of the problems of bark and knots and can only be dealt with by eliminating it as much as possible in the woods, in the yard, and by vigorous screening during the chipping process.

## ESTIMATE OF PULPMILL DELIVERED WOOD COSTS

### Marginal Sawlogs and Smallwood, Coast

The pulpwood costs used in the following discussion are as developed in Tables 6 and 7 of this report. They are actual costs net of the premium obtained by a logging company selling the sawlog component of the harvest. This premium and the resulting net log cost would vary from time to time depending on the state of the lumber market. However, for purposes of this study, it is assumed that sawmills will take any logs from which they can reasonably manufacture lumber.

While the economics of sawing marginal logs or pulpwood will vary greatly with the market for and price of small dimension and the lower grades of lumber, the fibre supply consultant believes that the sawmill company harvesting its own timber would only retain and chip this material if it was reasonably certain that they recover, in the chip and pulpwood price, the log cost value plus chip conversion cost. Alternatively, the material would be sold to a firm specializing in chipping at pulpwood prices.

The question to consider is whether the material can be chipped relative to the forecast of industry chip prices (Table 33). The following converts the pulpwood value in the extraction cost to a delivered chip price (in 1989 dollars):

| | SOUTH COAST AND VANCOUVER ISLAND | MID-COAST |
|---|---|---|
| Pulpwood Cost Net | $29.50/m3 | $33.95/m3 |
| Marine Transportation | 2.00 | 4.00 |
| Chip Conversion | 8.00 | 8.00 |
| Chipping Losses | 3.15 | 3.80 |
| Total Delivered Chip Cost | $42.65/m3 | $49.75/m3 |

Provision has been made for 10% losses in chipping which will likely occur with breakage and slabbing of small tops, and to provide for elimination of excess knots prevalent in this type of wood. In the event the end cost is too high or the disposal of the excess hog fuel is a problem, the alternative is to leave the smallest and knotiest material in the woods.

While the risk, with any weakening in the lumber market, is that the net pulpwood cost will be higher, delivered costs should still be within the range of chip prices expected by 1992. Fibre buyers will reach, preferentially, for the South Coast material first. However, if the supply is needed wood will move from the Mid Coast area.

The major constraint to the use of this likely more expensive wood, and assuming the necessary demand, will be the cost of alternatives: Harvesting decadent timber, transporting chips from the Interior, or importing chips and/or logs from other areas of the Pacific Rim.

Importing chips from other areas of the Pacific Rim plays the part of a price ceiling. Softwood could be imported in large quantities from the Southern U.S., Chile, New Zealand and Australia at a delivered price to a coastal pulp mill of about CDN $60/m3.

The closer delivered fibre costs in B.C. come to the price of $60/m3, the more seriously the alternative of importing chips will be considered.

## Harvesting Decadent Timber, Coast

The use of decadent wood can also be considered as an alternative wood supply available to the consuming coastal pulp and paper mills.

The scenarios presented in this section involving the harvesting of decadent stands (both Coast and Interior) assume that the stands that would be harvested initially would have a lower than normal, but still significant sawlog component. If such were not the case and the stands were harvested solely on the basis of their pulpwood content, the delivered chip cost estimates would increase. These would be calculated as follows (the example pertains to Decadent Harvesting - South Coast, see this section and Table 6):

| | | |
|---|---|---|
| Logging cost | - | $27.50/m3 |
| Haul/Barge | - | 7.00 |
| Stumpage | - | 0.25 |
| | | $34.75 |
| Decay Removal | - | 3.25 |
| Delivered Cost | - | 38.00 |
| Conversion to Chips | - | 8.00 |
| Chipping Loss | - | 6.00 |
| Delivered Chip Cost | - | $52.00/m3 |

The cost of pulpwood delivered to a conversion site from the three principal decadent forest areas has been calculated in Table 5. Delivered costs in chip form, exclusive of profit for the pulpwood using company harvesting the timber, are then estimated to be (in 1989 dollars):

| | SOUTH COAST | MID COAST | NORTH COAST |
|---|---|---|---|
| Pulpwood Cost Net | $30.20/m3 | $32.00/m3 | $32.75/m3 |
| Conversion | 8.00 | 8.00 | 8.00 |
| Chipping Losses | 6.00 | 6.40 | 6.55 |
| Chip Transportation | 5.00 | 5.00 | 5.00 |
| Delivered Chip Cost | $49.20/m3 | $51.40/m3 | $52.30/m3 |

As in the case of the pulpwood developed from improved recovery, provision has been made for chipping losses of 20 percent to allow for removal of excessive knots and decay or rot.

It is likely that any weakening of the lumber market, which will raise the net pulpwood cost of the chips, or problems in disposing of the poorer quality hog (due to rot content) will on occasion dictate that more of the poorer material will have to be left in the woods.

The delivered chip costs shown should be within the price parameters for roundwood chips that will exist in the future in 1989 dollar terms as forecast (see Table 33).

## Marginal Sawlogs and Smallwood, Interior

In Table 7 costs are shown for wood delivered to sawmills or processing plants within the hauling range as it exists today. As with the Coast, the extraction costs include an allowance for the smaller stems that are removed in the normal course of logging.

Chips produced from such plants would have to be trucked or railed to chip consuming mills. As in the case of the Coast, the fibre consultant believes that the sawmill and/or conversion plant or chip plant would need assurance of receiving, net at the mill, a price sufficient to enable it to recover the costs of the wood and chip conversion, including any gain or

loss on disposal of hog fuel. The fibre consultant feels that the net pulpwood costs charged against chip costs will be extremely sensitive to the lumber market with the risk being that they will be higher if lumber prices decline. The following sets out an order of magnitude estimate of the cost of such chips delivered to the nearest pulp mill (in $CDN per cubic metre):

| | CARIBOO | KAMLOOPS | NELSON | PRINCE GEORGE | PRINCE RUPERT (I) |
|---|---|---|---|---|---|
| Pulpwood Cost Net | $22.00 | $23.50 | $22.75 | $25.80 | $26.70 |
| Chipping | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| Chipping Loss | 2.20 | 2.35 | 2.30 | 2.60 | 2.65 |
| Haul to Pulpmill | 4.00 | 7.00 | 7.00 | 8.00 | 8.00 |
| Delivered Chip Cost | $36.20 | $40.85 | $40.05 | $44.40 | $45.35 |

These delivered chip costs (in 1989 dollars) appear to be well within the delivered chip price range that the fibre supply consultant expects will develop as the pulp and paper industry works up to the full capacity that will have been constructed by 1992.

Decadent Timber, Interior

In examining the South Coast's potential sources of supply from the Kamloops/Nelson region (which tends to be in a surplus fibre position) a recalculation of transportation costs to deliver this new fibre to a coastal mill is as follows (per cubic metre):

| | KAMLOOPS | NELSON | PR RUPERT (I) |
|---|---|---|---|
| Pulpwood Cost Net | $18.95 | $18.95 | $20.60 |
| Chipping | 8.00 | 8.00 | 8.00 |
| Chipping Loss | 3.80 | 3.80 | 4.10 |
| Haul to Coast | 15.50 | 21.50 | 8.00 |
| Transfer and Barge | 6.50 | 6.50 | -- |
| Delivered Chip Cost | $52.75 | $58.75 | $40.70 |

Except in the case of chips moving from the Prince Rupert Interior Region to the nearby North Coast pulp mills, these chips would be at the high end of the Coast's chip cost spectrum and come closer to the option of importing fibre from around the Pacific Rim.

Comments made previously regarding the impact of the lumber market on the net pulpwood cost and extra screening losses which increase the delivered cost of chips apply equally to the decadent timber of the Interior, as well as the Coast.

## OTHER SPECIES AND POTENTIAL USES

### B.C. Hardwoods

To date very little hardwood harvesting has occurred in B.C. On the Coast the use of alder has been intermittent but appears to be strengthening. Part of this interest involves the use of alder chips which, as a saleable by-product of lumber and veneer manufacture, make these operations more viable. Except for trials, alder chips have not been used in B.C. However, they have been exported (largely to Japan) from time to time and there are some chipping facilities in place which can produce alder pulp chips. Currently, Japanese companies are exploring the potential for increased alder chip imports from B.C.

The size and extent of the alder resource is not well documented and new inventory and supply statistics would be necessary to support any significant manufacturing for this species. One aspect of the resource which needs clarification is the amount of immature alder on the coast; particularly immature alder in mixed stands or alder "patches" in immature conifer stands.

The use of aspen in B.C. appears to be developing rapidly. Part of the impetus for this development comes from the relative success being exhibited by neighbouring Alberta. Current use in Northern Alberta includes pulp, composition boards and lumber, as well as other minor products.

Currently in B.C. Louisiana Pacific operates an aspen Oriented Strandboard plant at Dawson Creek and is in the process of developing a pulpmill at Pine River just east of Chetwynd. Fibreco has proposed an aspen pulpmill at Taylor on the north bank of the Peace River adjacent to their conifer pulpmill. Similarly, Alcan has proposed a pulpmill for the Vanderhoof area which would have two lines: one for aspen and one for conifer.

Aspen pulp chips, particularly those originating west of Prince George, also have an export potential. Considering an estimated manufactured cost of about $30/m3 and a transfer cost of $10-15/m3, aspen chips would have a cost on the Coast of $40 to $45 per m3. Shipments of alder chips to Japan in 1989 were within this range or slightly higher.

### Western Red Cedar

Increasing red cedar utilization (largely poor quality or decadent material) presents several problems. Foremost is the lack of interest by the pulp and paper industry in this species which appears to be well founded on two main technical criteria. One is that relative to other species, the yield is significantly lower. In comparison to hemlock/balsam or spruce/pine/fir, yields are about 80 percent based on bulk densities. Second, the material is highly corrosive in the pulping process and unless stainless steel equipment is used, at significant additional capital cost, problems usually occur in manufacturing.

Cedar can be highly desirable for certain types of paper, but at the same time these quality papers are intolerant of defect. In essence, there is some limited use for quality chips from sawmills, but not for chips made from decayed or knotty material. The increased use of poor quality cedar, or removing this material from the forest, is highly likely to involve removing smaller but sound pieces for a variety of other manufacturing uses, while the potential for increased fibre use from lower quality material is likely to come from some sort of composite based manufacture rather than pulping.

## Hog Fuel

Any increase in the extraction of lower quality timber from the forest is highly likely to cause the waste in manufacturing to increase. This means more bark and hog fuel, in general, compared to the current norm, will be available at manufacturing centres.

The most likely way of increasing the exploitation of this material is the expansion of its use as a fuel. However, the economics of its use at this date suggest that only where it is a low cost residual (and may be a disposal problem) can its use and the capital investment in the special boiler and ancillary equipment required be justified. Its principal use to date has been in supplying process steam to the pulp and paper industry.

A small but promising use of hog fuel that appears to be developing is the manufacture of pellets for home heating. While pellet production to date in B.C. has largely been test manufacturing some commercial production is being planned. Currently, pellets are imported from the U.S. Pacific Northwest.

A large number of pellet burning stoves have been marketed on Vancouver Island in the last year or so. The stoves are specially designed for efficiency and high combustion. The pellets appear to be quite competitive with firewood at recent bulk sale prices of about $125.00 per tonne (about $60.00 to $65.00 for a cord equivalent which would be just over 2 cubic metres of firewood). A combination of improved burning technology (largely in place) and improved pellet quality (in progress) are expected to provide significant emission reductions in comparison to conventional woodstoves. This product could play a small but important role in utilizing part of the excess hog fuel on the B.C. Coast.

In B.C. some interest has developed and B.C. Hydro is engaged in considering the generation of electricity from this waste. How far this interest in power generation will go depends on several factors, including the rapidly expanding availability of natural gas. If we look outside B.C. to areas that are energy poor, on a relative basis, better examples of application can be found.

An indication of the extensive use to which this "fuel" may be put is seen in the biomass fuelled energy plants of California. In this jurisdiction a combination of tax incentives and suitable electrical power rates has encouraged the building of numerous plants using all manner of woody waste as well as increasing quantities of surplus wood chips and hog fuel - hog

fuel that comes from chipping decadent wood and logging waste as well as a by-product from the more traditional wood product manufacturing process.

In California it is estimated that biomass fuelled plants in operation and in the planning and permitting process will soon have a total burning capacity in excess of 20 million m3 per year of this type of fuel. In most cases their permits do not allow them to burn any other type of fuel. This makes them aggressive buyers of wood waste of all kinds. In the recent past the break even delivered cost of wood fuel for these plants was estimated to be about CDN $20/m3. These plants are now buying significant quantities of surplus residual chips and chips produced from woodland waste up to the equivalent of CDN $24-$30/m3.

Trial shipments of hog fuel, from Vancouver, have been made to biomass plants in the Central and San Francisco Bay area of California. These trial shipments had a delivered cost of CDN $32/m3, and are estimated to cost less than $30/m3 if large bulk shipments were initiated on a regular basis. B.C. hog fuel appears to be marginally competitive in this California energy market and further investigation would be timely.

Also of interest is the use of shredded old rubber tires mixed with chipped or hogged wood waste to create a superior burning fuel. This is especially true for wet wood waste - as on the Coast. While the mixing of rubber and wood waste is being done on a limited basis in the U.S. Pacific Northwest, its use has been restricted due to environmental concerns about the effect of burning the metal cording in the tires. The metal can be extracted but a further significant cost is incurred. The concept of using this mix as a fuel seems worthy of further study as the use of old tires would solve two problems: the disposal of the tires and creation of a more efficient fuel from wet wood waste thereby increasing the potential demand for this material.

All in all, it might be worthwhile to put further study into the technology of using hog fuel, logging residue and wood from very decadent stands as a fuel or supplementary fuel, not only in view of the more stringent environmental guidelines coming into force that may limit its use and or disposal, but also to determine the preconditions that might make its sustained use practical in electrical power generation.

## Sawdust

As the use of sawdust (particularly large kerf) has been successfully tested for kraft pulp in B.C., it seems important to consider encouraging an expansion in the use of sawdust as a supplementary source of fibre to the pulp and paper industry - given the supply/demand balance and the cost of fibre this report anticipates. Currently, only three kraft mills in B.C. are using sawdust in the production of pulp: Eurocan at Kitimat, Fletcher Challenge's Elk Falls mill and Weyerhauser's Kamloops mill.

An expansion in the use of sawdust fibre for manufacturing pulp would not only relieve some of the pressure on the province's marginal sawlog resources but also permit an equivalent volume of currently surplus hog fuel to be used as fuel.

## 5. MARKET TRENDS

### MEDIUM DENSITY FIBREBOARD

World wide markets for MDF in 1990 are expected to consume 5.2 million m3, or 75% of total capacity. The following estimate illustrates the dramatic increase in European capacity.

| | 1988 Capacity | 1989/90 Additions | 1990 Capacity | Percent Increase |
|---|---|---|---|---|
| | ------- | 000's cubic metres | -------- | |
| Europe | 1,910 | 630 | 2,540 | 33% |
| North America | 2,170 | 350 | 2,520 | 16% |
| Asia & Other | 1,610 | 220 | 1,830 | 14% |
| | 5,690 | 1,200 | 6,890 | 21% |

North American capacity increases are expected to roughly match market growth increases of 7% per year, with production surplus being exported to a growing Asian market that is becoming increasingly short of fibre from traditional resource areas. The 1990 North American supply/demand estimate anticipates 78% capacity utilization.

| | 000's m3 |
|---|---|
| Capacity | 2,520 |
| Demand - North America | 1,800 |
| - Asia | 120 |
| - Europe | 50 |
| | 1,970 |

The outlook for the early 1990's is that European over-capacity will decline, with some recovery in North American exports to Europe, and that significant growth in exports to Asia will continue. The outlook for B.C. is very positive as both domestic consumption and consumption in all Pacific Rim countries is expected to increase.

ORIENTED STRANDBOARD (WAFERBOARD)

Worldwide markets for OSB and Waferboard are expected to consume 8,000 MMSF, 3/8" basis (7,080 thousand m3) in 1989, 96% of which will be produced and consumed in North America. Annual growth in demand over the 1985-89 period has been approximately 500 MMSF (440,000 m3) per year, or 10% compounded. Similar growth rates are expected to continue due to several factors:

- a 40% cost advantage over competing structural panels
- wide availability of suitable fibre resources
- the market acceptance now of OSB, and the ability to engineer OSB products to meet specific end use needs[1]
- process refinement in the adhesive technology, wafer geometry, dimensional stability and surface enhancement.

While most recent capacity increases have been in the southeastern U.S. future increases are expected in northwestern U.S. and western Canada, adding value to under-utilized species and lower grade fibre. Primary markets for this expansion will be in the Pacific Rim - notably Japan and the U.S. Overall 1989 North American consumption is estimated as follows:

| | MMSF 3/8" | 000's m3 |
|---|---|---|
| U.S. Production | 5,430 | 4,800 |
| Imports from Canada | 1,150 | 1,020 |
| U.S. Consumption | 6,580 | 5,820 |
| Canadian Production | 2,580 | 2,285 |
| Exports to U.S. | (1,150) | (1,020) |
| Exports Offshore | ( 50) | ( 45) |
| Canadian Consumption | 1,380 | 1,220 |
| Total North American Consumption | 7,960 | 7,040 |

The outlook for B.C. is excellent for OSB or waferboard as large increases in substitution for sheathing grade plywood are expected in North American markets. At the same time increased consumption is expected for both plywood (less developed countries) and OSB (more developed countries) in the Pacific Rim.

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1. Waferboard products designed for specific end uses is increasing and currently accounts for almost 20% of total production. These specialized products include siding, underlayment, concrete form, etc.

## PARTICLEBOARD

North American particleboard consumption continues to decline slightly each year in the face of competition from MDF. This is reflected by an estimated 1989 consumption of 3.2 million m3 versus a peak of 3.6 million m3 in 1986. Particleboard market reductions are expected to accelerate in North America as MDF costs improve and product availability expands.

The outlook for B.C., however, may be more favourable because of the Pacific Rim location. Market growth is still expected in Southeast Asia, Mexico, China and Korea. In these countries many applications not requiring the higher quality MDF will still be filled by particleboard provided there is a reasonable cost differential between the two products.

## ALDER AND ASPEN LUMBER

### Alder Lumber

Published sources on the production of alder lumber in B.C. are not available. Ministry of Forests and Industry estimates do indicate, however, that the general level over the past three or four years has been between 20,000 and 25,000 m3 annually on a solid wood basis. This would be about 10,000 MBF.

The U.S. consumes about 188,000 m3 or about 80 million bd. ft. of alder lumber from the Pacific Northwest annually. In addition, large volumes are exported. In 1985 some 85 million bd. ft. were exported and this has risen to nearly 150 million bd. ft. in 1989. While most of this production goes to countries in the Pacific Rim (Japan and Asian countries), significant volumes are exported to Europe. The Japanese imports are largely in the upper lumber grades but the European imports are largely pallet stock. It is interesting to note that during the same time period average lumber prices in the export market have held firm at about $520 to $580 U.S. per MFB. Domestic U.S. prices during the same time period have increased some 15 percent (from about $425 U.S. to about $507 U.S. per MBF).

The market outlook for alder lumber for coastal B.C. appears very promising. Foreign demand is strong and prices (in U.S. dollars) appear to be stable if not increasing.

### Aspen Lumber

Markets for aspen lumber would have to be developed. However, some particular examples concerning the use of aspen lumber in the U.S. indicate that it can substitute for other hardwoods and softwoods. In the Lake States use of aspen lumber includes door core stock, low-cost furniture and kitchen cabinets. A large portion of the lower grades of aspen lumber go into pallet stock. The disadvantage of "softness" precludes some heavier duty pallet uses but these have been partially compensated by modified or

reinforced pallet design. Weight reduction in the pallet for some uses is a distinct advantage. Tests conducted in the Pacific Northwest indicate aspen pallets can be substituted for alder pallets for several uses.

The outlook for B.C. for aspen lumber is uncertain at this time. Both market research and applications research would be necessary in advance of manufacturing.

## SLICED VENEER

Statistical data on production and shipments of British Columbia sliced veneer products are not available from governmental surveys because of disclosure regulations concerning a limited number of establishments. At present, sliced veneer production from B.C. softwoods is estimated to be some 18,000 m3 annually, of which 12,000 m3 is from "cants" exported to the U.S. for secondary slicing.

Markets for softwood sliced veneer products are diverse, ranging through all areas of Europe, North America and Japan. Buyers for these products include panel and furniture producers, millworking overlayers and producers, finger joint lumber producers and specialized timber producers (Japan). Total markets for sliced veneer are not readily estimateable, but are certainly significant and growing. A total market for up to 50,000 m3/annum of sliced softwoods is estimated to be available to B.C. based producers.

## SMALL LOG LUMBER

Markets for small log lumber would fall into the general category of softwood dimension lumber. Total Canadian production of softwood lumber was over 60 million m3 in 1988 with some 37 million m3 being produced in B.C. Of these above amounts over 20 percent is estimated to come from small logs.[1]

About 40 billion m3 of lumber are exported and both export and domestic demand appear to be increasing. Exports to the U.S. have been particularly strong since 1982.

There is little reason to believe that with strong demand and a market acceptance of some 20 percent that the smaller sizes (including shorter lengths) of dimension lumber are not finding useful, consumer applications. If real sawnwood prices continue to rise the outlook for further production of this product in B.C. should be excellent.

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1. Logs from trees, in general, that have a diameter at breast height of 23.5 to 22.5 cm (5 to 9 inches), or logs from the upper stem position of larger trees that would have a "butt" diameter of 15 to 25 cm (6 to 10 inches) and a "top" diameter approaching 10 cm (4 inches).

## PULP CHIPS

The outlook for pulp chips has been covered in detail in the section on increased utilization for pulp fibre. This outlook is based on the need for coast pulpmills to acquire increased pulp chip inputs for capacity that is currently under construction. The new capacity was planned on the basis of increasing world demand for pulp and newsprint.

Production of wood pulp in B.C. has increased from about 5.9 million tonnes in 1985 to 6.0 million tonnes in 1988. B.C. is the largest exporter of wood pulp in Canada. Major markets are the U.S., Japan and the European Economic Community. Canadian newsprint producers have lost some of their U.S. market share in recent years, but B.C. producers have run counter to this trend with increased U.S. sales, particularly to California and the U.S. west coast in general. Part of the reason for the increased market share is sheet quality in comparison to alternate suppliers. This quality has as its basis a high proportion of western hemlock fibre.

There is a pulp chip trade evident on the B.C. and U.S. Pacific coast. In the late 1970's and early 1980's between 1 million tons and 1.5 million tons of pulpchips left B.C. for U.S. Northwest Customs Districts annually. By the late 1980's this decreased to less than 0.5 million tons annually. During the same period imports of chips from the U.S. to B.C. (largely from Washington and Alaska) have increased from about 5,000 tonnes annually to a magnitude of some 100,000 tonnes annually.

## LUMBER FROM DECADENT HEMLOCK

Markets for product output would fall into the general category of dimension hemlock lumber. In B.C. on the coast this would include cargo hemlock (largely to U.S. Atlantic ports) as well as kiln dried hem/fir. In the Interior the basic product is kiln dried hem/fir. These lumber items are well accepted and appear to be holding or slightly increasing their position in the U.S. market.

In recent years exports of B.C. cargo lumber have gained a small but growing market in California and U.S. southern and southeastern states. Imports of Canadian lumber into western custom Districts (some to Montana but most to California) have increased from about 400 million bd. ft. to about 750 million bd. ft. Imports to the southern Customs District (Maryland to Florida to Texas) have increased from about 500 million bd. ft. to about 1.0 billion bd. ft. Prices over the last five years for hemlock dimension have increased about 5 to 10 percent in the smaller sizes (i.e. 2" x 4") and some 25 to 35 percent in the heavier sizes (i.e. 2" x 10"). With real prices continuing to rise, the B.C. outlook for hemlock dimension appears good. However, as quality may decline with increased utilization of marginal stands, relatively lower prices might be anticipated.

# 6. RELEVANT PUBLIC POLICIES

A wide range of federal and provincial policies bear on the current "market" utilization of forest resources in B.C. This study cannot provide details of each. However the impact of a few key policies can be clarified through reference to data collected and relationships simulated by the study. Not all of the important policies are in forestry; significant impacts are caused, or could be impacted by taxation policies, energy policies, import/export policies, research-development policies, social policies, and environment policies.

The wording of policies, laws and regulations in each field is often subject to interpretation, and often the actual application can only be tracked through detailed study. Usually by the time such studies have been completed, the interpretation or the law/regulation has been changed. Therefore this report will attempt to clarify important directions for policy, rather than details.

## FOREST POLICIES

### Forest Allocation Policies

The most important set of public policies in the B.C. forestry sector are those that allocate timber harvest rights over time. Timber tenure has been the subject of three B.C. Royal Commissions since 1945. The basic objective has always been to achieve maximum social gain for B.C. citizens through efficient utilization of the Province's most important asset - forest resources.

Allocation policy has been substituted for market sales of standing timber, as the primary mechanism of industry development and allocation of raw materials. This is not to say that powerful market mechanisms are not at work on sector allocations of all kinds (e.g. world lumber markets and paper markets are competitive, and substitute materials usually challenge each forest product).

The prices paid for standing lumber (stumpage) have traditionally been calculated in a manner which emulates net market value, rather than being set by public auction. Stumpage has always been a policy variable in B.C. forest sector development to date. At times B.C. MOF has also intervened in primary product markets (logs and chips) in the province to ease problems in the wood allocation system.

In the past few years important changes have been made to absorb (within provincial revenues) the 15% duty on lumber shipments to the U.S., imposed as a result of countervail action by U.S. producers.

At present the B.C. Legislative Committee on Forestry, and a new permanent Forestry Commission are studying forest allocation/tenure along with other policy issues.

This study will not delve into B.C. forest allocation polices, but recognizes that they impinge on all forest sector activities in the province. They will have important impacts in future utilization trends and events, as they often have in the past.

## Raw Material Export Policies

Log exports from Crown lands have been prohibited, as an important element of forest policy in B.C., since 1901. This policy has been an important supplement to allocation policies aimed at deriving maximum domestic value from timber harvests. A federal interest in log exports has also been maintained, through trade policy.

A few exceptions have always been recognized by the general log export ban. Special grades and species, which were not manufactured to their potential in B.C. could usually be exported (e.g. high grade Sitka spruce, yellow cedar). Lands which were privately held before 1906 (old Crown Grants) were granted an exemption. This privilege remains but is now subject to special export taxes by the Province.

For several decades a special export permit system has been administered by a Log Export Committee, with the basic objective of assuring that any exported roundwood is not demanded by the B.C. industry (Federal-Provincial-industry membership).

In the 1980's a new concept/strategy emerged in B.C. log export policy - the concept of "export stands". These were defined as stands which could not be economically harvested without a component of the stand being passed for export, before logging. The higher-priced export logs helped to raise the average revenue for the stand above average total cost of harvest. Thus additional wood could be made available to the local industry as well.

The new policy represented a significant departure from precedent, as no direct "logging for export" had been permitted on public lands. Only surplus logs already brought to market had been considered for an export permit.

## Stand Harvest Policies

The variability of native forest stands in B.C. is larger than in most forest regions of the world. From sea-level to high elevation, from high precipitation to arid, and over rough terrain and variable soils, a highly variable set of forest communities has evolved.

Historic practice for the harvesting of stands in B.C. could be encapsulated in the general rule "best-first". In each time period "best" and even "acceptable" had very different definitions according to technology and markets of the time. As the largest timber in the most accessible locations became depleted, the industry developed or borrowed

technology to handle smaller wood, rougher terrain, and even different species.

Recent B.C. MOF policy has indicated that harvesting should be working towards the "average stand profile" in each tenure (within the current operability limits) so that current industry economics are not being served at the expense of future prospects. A forest area from which all the best stands have been removed may become subject to sudden, socially undesirable loss of economic activity. However, current practice is not as far from the old "best-first" rule as policy/regulations would specify, in most sub-regions of the Province.

Both the Ministry and the industry recognize the problem and are working towards achieving the goal of using a cross-section of all stands within a tenure or management unit, within one time period. The problem of defining the "current operability limits" for each planning period should be noted (for example, see Fraser TSA Yield Analysis Case Study).

To the extent that economically inferior stands are pushed forward in the harvest queue by this policy, both the log/product mix and the expected volume and type of forest residuals will change for that period.

It is obvious that the policy/regulations on what can be left behind after logging will have an important interaction with those which specify which stands should be harvested.

The estimates of "merchantable" and "marginal" wood available in the expected harvest from stands on TSA lands provided in this report (see Tables 1 and 2) represent a pioneering attempt to link the expected stand harvest profile with the expected logging waste from these stands to define a "new" resource - the total available volume of wood which is marginal in current operations.

For many years B.C. forest policy has recognized that at one extreme the basic primary use of some stands may change (from historic sawlog use to pulpwood, for example). The first pulpwood harvesting area tenures were granted in the early 1960's in the Interior, and a few original Pulp Licences were granted on the Coast in the early 1900's.

However very few stands in B.C. history have ever been harvested as pulpwood-only. As sawmill technology shifted, even small logs were processed first to recover lumber, with the chips made from slabs and edgings transferred to a pulpmill.

One other policy-set has important effects in selection of stands for harvest - log export policies. The permission to export portions of a stand (to higher priced and specialty markets overseas) can enhance the "logging chance" of particular stands in one period.

## Allowable Waste Policies

The native variability of forest stands in B.C. is also important in defining and monitoring policies to control logging waste. Portions of

each stand are more difficult to harvest, and less desirable in manufacturing plants because they contain:

- undesirable species
- smaller pieces
- shattered or cracked wood
- higher proportion of knot-wood
- stained or rotted wood
- bark seams
- irregular shapes, bends

The amount and type of such "defect" varies with stand history, age, species, terrain, logging system and other factors. The cost of extraction varies mainly with piece-size, terrain and logging system. The degree of "acceptability" in manufacturing varies with markets and processing technology in each period. For example, virtually all of the material is potential fuel, if the alternate price of energy is high enough.

Recent ecological studies indicate that at least some large woody debris plays an important role in sustaining long-run soil productivity in many B.C. ecosystems.

Not surprisingly, an array of policies and regulations have been used over time to encourage "close utilization" of each stand felled in annual logging. The problem does not lend itself to simplistic rules, within large and diverse forest regions. In uniform, simple stands like those found in pure lodgepole pine, a simple rule (such as minimum top diameter to be extracted) can be made to work. However in mature Coastal stands where branches can be larger in diameter than pine stems, the same rule would not have the same meaning.

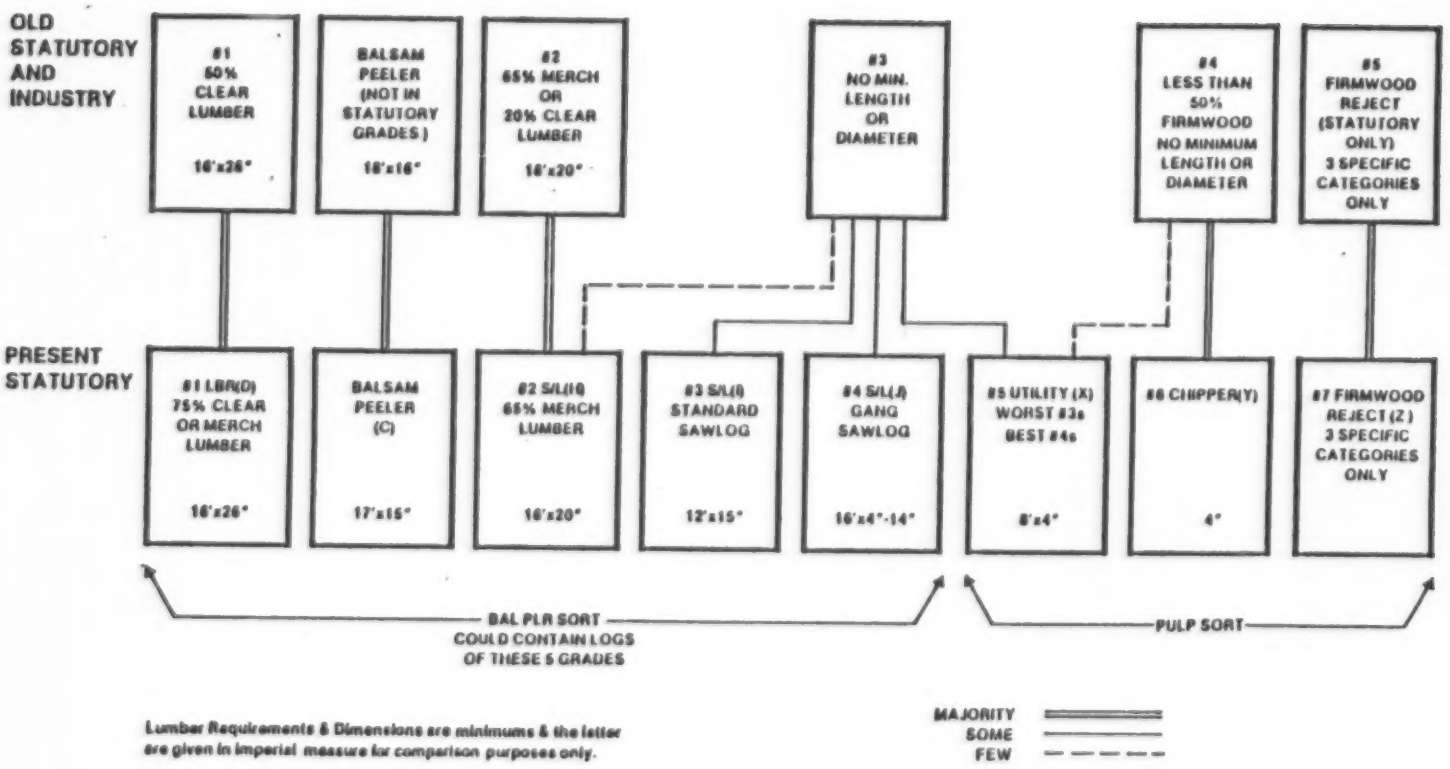
In the bulk of mature B.C. stands, where most of the logs will be directed first to breakdown in a wood products mill (sawmill or plymill), a fairly complex definition of log grades is central to definition to "close Utilization" in economic terms. Political phraseology such as "zero tolerance" is very useful in defining the current policy environment and the desired direction of practice. However, detailed definitions and interpretations are required for each hectare of real forest.

Figure 1 illustrates the problem, for hemlock and balsam (hembal) log sorts. The figure shows the most recent previous statutory (B.C. MOF) and industry-usage grades, as they compare with/integrate into the latest statutory log grades. It should be noted that the log grading systems of B.C. have changed or modernized many times previous to the changes shown on this chart.

The chart also shows the current statutory definition of "allowable waste" in logging hemlock and balsam stands. All logs to the left of and including #5, utility (X) will be charged at full stumpage, and charged to the allowable cut of the tenure-holder, even if left in the woods. Annex 3 provides other examples of the complexity of log grades (that is, complexity of utilization) in the B.C. forestry sector. The annex also provides some of the important basic definitions of diameter, length, defect, etc., used in field assessments of logging waste at present.

Figure 1

## HEMLOCK AND BALSAM


OLD STATUTORY AND INDUSTRY
#1 50% CLEAR LUMBER 16'x26"
BALSAM PEELER (NOT IN STATUTORY GRADES) 18'x16"
#2 65% MERCH OR 20% CLEAR LUMBER 16'x20"
#3 NO MIN. LENGTH OR DIAMETER
#4 LESS THAN 50% FIRMWOOD NO MINIMUM LENGTH OR DIAMETER
#5 FIRMWOOD REJECT (STATUTORY ONLY) 3 SPECIFIC CATEGORIES ONLY
PRESENT STATUTORY
#1 LBR(D) 75% CLEAR OR MERCH LUMBER 16'x26"
BALSAM PEELER (C) 17'x15"
#2 S/L(B) 65% MERCH LUMBER 16'x20"
#3 S/L(I) STANDARD SAWLOG 12'x15"
#4 S/L(J) GANG SAWLOG 16'x4"-14"
#5 UTILITY (X) WORST #3s BEST #4s 8'x4"
#6 CHIPPER(Y) 4"
#7 FIRMWOOD REJECT (Z) 3 SPECIFIC CATEGORIES ONLY
BAL PLR SORT COULD CONTAIN LOGS OF THESE 5 GRADES
PULP SORT
MAJORITY
SOME
FEW

Lumber Requirements & Dimensions are minimums & the letter are given in imperial measure for comparison purposes only.

One of the most important purposes of measuring what is left behind after logging is to establish a viable measure of what has been taken from inventory in total, in addition to what has been removed and scaled as commercial wood. The forest inventory estimates of tree and stand volume (which are used in projecting harvestable volumes and allowable cuts) are developed separately from the actual scale/measurement of harvest from each stand. In general, they contain much simpler definitions of merchantability and total volume than those which become operational after felling. There is at least a risk of an "information-gap" between the two levels of data regarding future forest harvests, and what is feasible in any planning period.

## Allowable Harvest Policies

This most important aspect of forest policy has been left to last in order to clarify the interaction with other elements of forest policy, and the importance of an integrated approach, purely on the economic wood production front. In addition a large set of social and environmental objectives and policies is brought to bear in setting the level of allowable harvest (allowable annual cut - AAC) in each management unit of B.C. public forest, in each planning period.

The AAC for each management unit of public forest (TSA/TFL) is set by a combination of forest simulation and current industrial wood demand estimation, for each five-year period. It is clear that definitions are critical, both in the ability of the forest to provide, and in the ability of the industry to utilize various woody materials.

Current B.C. industry demand, as expressed by total harvest 1987-90 (net of log and chip exports) is 85-90 million m3 of roundwood per annum. The current total for AAC's on public forest management units is set at 75-77 million m3 per annum. The balance is currently being harvested from "other" tenures such as old temporary tenures not in a management unit, special sales areas (e.g. clearing for hydro, agriculture, salvage), and private lands.

Both the economic and physical definitions placed within the forest simulations (computer models) which are used to project the AAC are complex and variable. They are specialized for each forest management unit.

On the economic side, the "Operable area" is defined for the planning period, based broadly on combinations of stand type, terrain and distance from mill(s). One of the clearest messages from experience in B.C. over the past century is that the "operable area" changes radically with technology and markets.

On the physical side, stand areas and descriptors (species, age, height, stocking, diameter distribution) are estimated through remote sensing and field samples. B.C. systems in this field are at the edge of world technology. However, much of the data so acquired can become obsolete. Timely use of the data is just as important and must go hand in hand with any new inventory data development programs.

Also, on the physical side, stand volumes and growth rates are based on forest inventory data acquired in natural stands. These stands are the result of natural seed fall after fire, windfall or other past disturbance. There is grounds to question how well these data project the behaviour of stands being formed under human management (protected from fire, planted and spaced, etc.).

The expected time of harvest of each forest stand (the rotation) is either specified for, or calculated by the model based on a combination of expected physical growth rate and economic operability of each defined stand-type.

A new dimension has been added to forest monitoring and projection with the advent of operational GIS (Geographic Information Systems) technology. Each defined forest stand or type can be located - physically, economically and institutionally. About 75% of B.C. public forests have already been computer-mapped in this fashion. This technology makes it possible to analyze timber allocation strategies, harvest profiles over time, and harvest economics in new ways.

The technology has been used in studies, but not yet in operational AAC policy-setting. The new computer map must of course be up-to-date to be most useful, just as the traditional system. The GIS-based system does offer the prospect of modern data-acquisition as systems become operational (e.g. satellite-image definition of new harvest areas).

In the existing set of AAC definitions for public forest units (35 TSA's and 32 TFL's) two basic prospects are usually outlined, in the form of projected trend-lines:

- the present and expected harvest volume per annum
- the basic growing capacity of the defined lands (long-run sustainable yield or LRSY)

These emerge for public scrutiny in the form of diagrams and data similar to that shown in Figure 2. The state of the critical assumptions and data which were placed in the model, resulting in these projections, is often ignored in the resulting public debate.

Important variables in each analysis include:

- the vintage of the forest inventory
- the relevance of the growth projections
- the assumptions regarding operability
- the assumptions regarding utilization
- the proposed environmental protection areas and rules (limits on harvesting)
- the assumed rotations
- the projections of wood-use by industry (and implied costs and product prices)

Changes in each of these policy variables and data-sets can have significant impact on the projected AAC for the planning period, and on the defined long run sustainable yield.

Figure 2

**Most Common Regional Wood Supply Pattern (schematic)**

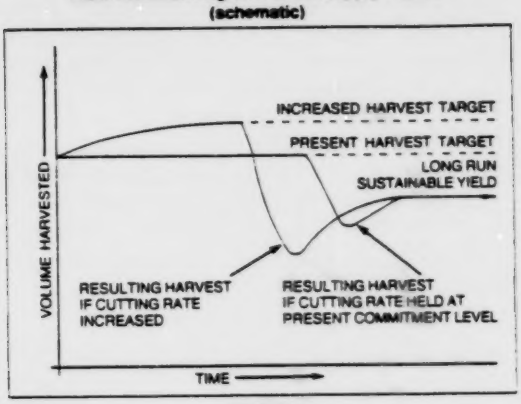

INCREASED HARVEST TARGET
PRESENT HARVEST TARGET
LONG RUN SUSTAINABLE YIELD
VOLUME HARVESTED
RESULTING HARVEST IF CUTTING RATE INCREASED
RESULTING HARVEST IF CUTTING RATE HELD AT PRESENT COMMITMENT LEVEL
TIME

**TABLE 1**

**Provincial Wood-supply Picture by Region and the Variation Between Areas Within Regions at Current Commitment Levels**

| Region | Years Until Forecasted Supply Falldown Begins (By Region) | Estimated Range in Years Until Forecasted Falldown Begins (Within Regions) |
|---|---|---|
| Bulkley-Northwest | 40 | 5 - 60 + |
| Cariboo | 100 + | 10 - 100 + |
| Kamloops | 30 | 10 - 40 + |
| Nelson | 70 | 5 - 70 + |
| Peace River | 100 + | 20 - 100 + |
| Prince George | 60 | 5 - 100 + |
| Prince Rupert | 80 | 10 - 80 + |
| Vancouver | 50 | 10 - 60 + |

The opportunities which are outlined in this study for improved/increased utilization of stands and logging residuals can impact both the AAC projection and the LRSY projection for a given management unit. The impact can be caused by:

- moving the industry closer to harvesting the real stand profile of the unit and thereby reducing the exclusions for "inoperability" in both AAC and LRSY calculations
- bring back into the AAC calculation areas which had already been excluded as inoperable
- increase the rate of growth on each hectare which was overmature when harvested from zero to near the maximum for the site, and conceivably shift to more valuable species
- effectively reduce the area which must be felled to achieve any given total harvest target (the improved utilization effect), which provides extra flexibility to meet environmental constraints, and avoid fall-downs in future.

For example, the marginal volumes shown in Tables 1 and 2 are outside of current AAC calculations/definitions. To the extent this volume can be recovered, AAC has been effectively expanded. Similarly for decadent and marginal stands - not all are currently included in AAC estimates. The detailed effect cannot be simulated without reference to detailed TSA analysis, including use of GIS, but it will be positive.

## ENVIRONMENT POLICY

As the largest B.C. land-user, energy-user, materials-handler and manufacturer, the forestry sector lays a major role in society-environment interactions in the Province. A wide array of public policies have significant impact on sector activities at present.

Public environmental concerns, and policies aimed at achieving reduced pollution from mills, and a better balance with nature and outdoor recreation in harvesting operations, are dominant priorities for the 1990's.

Important policy-sets with significant impact in the sector include industry emission controls, fisheries and oceans, wildlife and freshwater fish, watershed management, forest-based recreation and wilderness preservation.

### Industry Emission Control Policy

The study treats this field of policy as a constraint - that is, any mill deemed viable over the next decade will be able to meet societal standards for emissions to air, land or water.

In this high-tech field, where this year's top concern probably wasn't even know to exist last year, this is a risky assumption. However certain processes are known to entail higher risks and require more stringent controls than other processes.

Relatively risky processes (even though they may have been in operation for decades) include:

- wood preservation, coating, gluing
- wood-dissolving with acid or alkaline solutions
- bleaching pulps and papers
- burning wood and other wastes
- storing large quantities of wood/other wastes
- storage/use of large quantities of petro-products

Many of the activities outlined in the utilization section involve these processes. However in each field the latest technology meets current industry emission standards. Even more importantly, technology development in this field is moving rapidly to seek economic solutions to significant new emission problems and standards.

Some of the activities proposed would have significant positive impact on industrial emissions. Examples include:

- reduced leachates into streams or groundwater from piled or buried wood wastes from mills and log-yards.
- reduced debris in coastal waterways
- reduced sulfur emissions from industrial burners currently using bunker C oil

Fisheries and Oceans

Logging practices in B.C. are modified in many ways to protect streambanks and estuaries, for sustained production of salmonid stocks. The regulations are varied according to the importance of each stream in the fishery, slope and terrain, etc.

One of the largest environment protection areas (EPA) in total is the streambank strips which are left to reduce siltation and lower water temperature in forest streams. These areas are deducted from AAC calculations.

In addition, logging debris must be removed from even small watercourses, to avoid entrapment of water and scouring effects which increase erosion and silt in streams below. There are many variables in this environment, and regulations are not easily written or interpreted in the field.

Any activity which reduced the volume and number of pieces of logging debris would generally have positive environmental impact on watershed control, and water quality for fishery use.
In estuarine environments, many changes in logging practice have been adopted to better protect this critical habitat. Examples include moving booming grounds, and moving more logs on barges rather than in open rafts (reduces log losses in towing). Activities which utilize lower grade logs and other problem pieces will lower the amount of flotsam and jetsam which finds its way into coastal waterways and estuaries.

A simple prescription to reduce allowable waste in harvesting, without a utilization strategy, will tend to have the opposite effect - stray uneconomic pieces in waterways will tend to increase.

It is important to preserve a few such completely natural working ecosystems (to the degree possible given other human impacts on the general atmosphere, etc.).

All other levels of wilderness use involve various forms of interaction with human activities as well as protection of relatively wild forest systems. None of the improvements in utilization of marginal B.C. forest resources analyzed in this report can be deemed to have especially negative impacts on protection of natural systems within the managed forest estate of British Columbia.

## Wildlife and Forest Recreation

Many ameliorative techniques have already been adopted by the forest industry to reduce negative impacts on wildlife and fresh water fish or even enhance the habitat for some species. The most important action of logging is to create a group of new openings in the forest each year. Of secondary impact but serious concern for some species is the temporary disturbance of logging machinery, etc., in the landscape.

The impact of these actions is quite different for different species. The new openings tend to favour a large group of species, several of which are often used by society (hunting or non-consumptive use - camera, etc.).

These include white and black-tailed deer, mule deer, moose, and most grazing/browsing animals. The woodland caribou is an important exception, requiring more or less closed forest over at least part of its range.

Most wildlife prefers a mixture of openings and closed high forest for cover, passageways and corridors, etc.

Grouse, partridge and many other birds prefer openings with edges. This habitat is quite natural to most specie ecosystems where the closed forest cover is often broken by fire and/or windthrow.

Within the current managed forest landscape, some particular habitat "niches" are not adequately provided for at the present. Examples include snags used by woodpeckers and owls, and small ponds used by woodducks.

Most of our carnivores and omnivores such as wolves, cougars, black bear and raccoons adapt well to the new openings and the increased small game populations. Even though the food available may increase, the grizzly bear does not like the disturbance caused by loggers and their vehicles.

Obviously the degree of threat to a particular species and its ability to adapt to managed forest conditions should be a factor in decisions regarding forests set aside for wilderness preserves.

While open area users may adapt to managed forest conditions, some are better accommodated in decadent forest stands where windfall areas create the desired opening. Decadent over mature stands should accommodate these species as well as the few specialized species which can use only closed mature forest. In this regard, the harvesting of decadent forests must be considered with the above needs in mind, such that sufficient stands are available in one time period to adequately protect and conserve the above species.

Improved land use planning procedures (including GIS being used to denote habitat areas, recreation areas, limited use areas and forest production areas) can enhance the managed forest landscape for all users. Note, for instance, it can be used to identify new recreation opportunities as most forest related recreation involves access via logging roads.

## TAXATION POLICY

The majority of the tax policy network of the Federal, Provincial and Municipal Governments in Canada is generally treated as given in this study. The one exception is the Municipal property taxes imposed on forest industries within their boundaries (may, in fact, be provincial taxes if unorganized territory). Both Municipalities and the Province in B.C. have in the past given property tax incentives to new industries to induce employment and new tax bases to particular areas.

One of the incentives simulated in Section 3 involves reducing the mill rate on new proposed forest industry operations in line with these incentive practices.

## IMPORT/EXPORT POLICIES

The long history of log export controls in B.C. shaped the forestry sector in its present form. The study does not assume that any major changes in the basic policy of exporting only materials which are surplus to the needs of the current industry are likely to occur or are even desirable. They will continue to be revised in the short run to fit the current situation while achieving the long term objective of manufacturing in the province.

Chips also require a special permit for export. The process requires more careful consideration of each permit because a larger volume is usually involved. Chip importers usually require long term contracts and significant volumes to guarantee markets and arrange for shipments.

While pulp capacity in B.C. was below the total production of pulpable materials from mill residuals and roundwood in combination a real need for export permits could be demonstrated to avoid wasting chips through deterioration, and to maintain equitable pricing from sawmill to pulpmill.

Export of other primary or intermediate products (e.g. shake blocks) has attracted policy makers attention from time to time in B.C. forest industry history. Again, maintaining domestic manufacture was the key concern.

The study has not assumed any change in basic import/export policy in the B.C. forestry sector. However, if detailed study revealed a good reason why increased exportability of a particular commodity or product appeared likely to induce more rapid achievement of the desired objectives, some recommendations or policy questions in this field might be forthcoming in proposed utilization studies.

## ENERGY POLICIES

Various policies in the energy sector have significant impact in the forestry sector of British Columbia. The sector is the largest energy user in the province. It is also the largest producer of wood based energy within its operations, and the largest potential producer of such energy.

Two essential elements of energy policy will impinge on improved forest utilization in B.C.:

- the price paid for cogenerated power from burning wood wastes
- the pricing and supply policies for natural gas on the B.C. coast pipeline under construction (a potential substitute for burning wood wastes).

Neither of these aspects is dealt with in detail in this study, nor is it crucial to any of the operations simulated. However, it is clear that the prospects of improved utilization in general may be favourably or unfavourably influenced by the resolution of these important energy policy questions.

## RESEARCH DEVELOPMENT POLICY

Federal research policy in the energy sector (ENFOR and FIRE programmes) have already had significant impact in defining and improving the prospects for closer utilization of marginal forest materials in B.C. and other parts of Canada. Wood products technologies are the subject of continuous research development at FORINTEK. Similar activities by the Pulp and Paper Research Institute of Canada has enhanced the prospects for utilization for marginal materials by this industry.

However, neither of these important agencies has been asked to focus on important aspects of the marginal forest materials utilization problem.

As warranted by study recommendations, each of these agencies, together with the Forest Engineering Research Institute of Canada might be asked (funded) to pursue particular aspects of the problem.

# 7. CONCLUSIONS - STRATEGY

The study has produced one important conclusion - "marginal wood" must and will be radically redefined in the 1990's. B.C. MOF policies are changing in response to demands for enhanced environmental protection and economic efficiency in the forestry sector. Wood and fibre supplies are short, and world prices generally are rising over the long term.

A brief summary of conclusions regarding the expected economic future of the sector will be useful before proceeding to recommendations for action.

In part, this section outlines the limitations of the study, and provides some insight into the information needed to develop sound strategies to improve utilization on a regional basis in B.C.

## FORECAST OF TOTAL B.C. HARVEST-DEMAND FOR WOOD

The defined sawlog harvest in B.C. is fully utilized at present, and industry capacity in fact exceeds current definitions of sustainable supply in most regions of the province. Material suitable for manufacture into wood products is most likely to enjoy real price increases under scarcity. This in fact merely represents a return to a trend which has been consistent in North America for over a century.

Fibre for pulp is also becoming scarce in B.C., with construction of new/additional capacity using 5 million m3 by 1992 (see table 31). The question of whether wood product prices (lumber, plywood, wood based panels) will rise rapidly enough in the 1990's to permit these mills to profitably purchase and mill the lower quality sawlogs (which will be produced in larger quantities during the period) is open to debate.

If housing and other major wood product markets slump in the 1990's, or find alternate materials, B.C. will likely undergo a major shift from its traditional wood product-dominated position in utilization. That is, pulpmills will be able to buy marginal sawlogs away from lumber/panel use. A higher proportion of chips will come from roundwood, and unless sawlog harvest increases from new sources (e.g. environment reserves), capacity in the wood products segments of the forestry sector will decline.

More and better market and/or product technology information will be required to define an appropriate strategy for the Province in wood products. Technological market defenses appear feasible in wood products, but are not automatic.

The longer run history of scarcity prices would indicate that sawlogs (by whatever definition) will enjoy better price performance than pulpwood. The addition of vast short-fibre (hardwood) resources to the economic pulpwood resource in the 1980's through technology and marketing, is a good example of how fibre supplies can be rapidly expanded.

It would be unwise for the Province to enter such a period of adjustment without better technological forecasts and market data for all product-markets available to B.C. forest industries. The question is important because the systems of timber allocation tend to internalize inter-product decisions within existing corporations. In the short-run, a corporation will naturally be more concerned about the billion-dollar mortgage on its new pulpmill, compared with the million dollars left to pay on its old sawmill.

In the field of wood-based energy, the principal demand questions are governed by policies/events in other sectors. The pricing systems used for purchase of cogenerated electric power (by B.C. Hydro) will govern the economics of significant new ventures in this field (e.g. Williams Lake). The financing/construction/pricing policies involved in the Coast Gas Pipeline will have major impacts on the future use of wood wastes in pulp-mill burners on the B.C. Coast.

In any event the "burnable" fraction of harvested wood resources will continue to be a residual, left over at various stages of the integrated forest products manufacturing chain. One of the key incentives to burn this fraction will continue to come from the rising cost of disposal by other means.

As the harvest of "marginal" forest materials increases, the fraction suitable only for burning also increases. It is clear that development of new ways to extract and refine "marginal" sources of wood and fibre will have great economic value in the B.C. forestry sector in the 1990's.

## FORECAST OF SUSTAINABLE SUPPLY

A second conclusion of the study is that the forest inventories, definitions of marginal materials, growth and yield forecasts, and forest estate models currently in use in B.C. all need work if they are to provide appropriate guidance in managing the emerging problems of the 1990's.

Some form of "falldown" from present harvest levels has all the earmarks of a self-fulfilling prophesy under current conditions. A few examples of the problems of these critical information systems include:

- out of date estimates of areas and volumes of stands
- inadequate estimates of pest/fire losses
- problematic estimates of growth/yield in managed stands
- no operational links between silvic records (which keep track of $200-300 million in annual silvic investments) and forest growth projection
- inadequate definition of the "operable" or economic resource, in terms of total area or in terms of marginal raw materials within each stand
- inadequate definition of environment protection areas, or other environmental constraints on harvesting practice.

B.C. MOF has been working with "best - current" estimates for these factors in each TSA (and TFL) analysis of supply. The tightening supply/demand situation of the 1990's will require new, more refined estimates based on study and projections.

It is known that the annual area harvested will increase (for a given total volume) as the volume per hectare declines gradually. Moving now towards the real stand profile in each region, and improving the level of utilization of each felled hectare, will help to mitigate this effect, and to prevent "falldown".

One of the most critical variables needing physical study, economic definition, and improved communication with the ultimate resource owner (B.C. public), is that of the expected environmental impacts of harvesting. Directly related is the need for improved definition of environment protection areas (EPA's) within the production forest, and of a host of smaller mitigating practices (e.g. leaving some trees, snags or patches of forest with the specific intent of bird or animal protection or use).

A good deal of fundamental work is needed on the inventory, population dynamics and behavior of many forest flora and fauna. The cost of such work will be low in relation to massive forest removals from the productive base, for supposed "preservation". In fact, such "preserves" may have a lower likelihood of protecting species than does a sympathetic, competent management program over much wider areas.

The geo-referenced forest database which has been developed at great cost in B.C. has not been sufficiently used in operational studies. New software is needed to link the GIS database to economic, social and environmental studies in each region of the Province.

As the best GIS technology is relatively new, and as B.C. is already a world leader in application (at least in data-entry and updating systems) a significant opportunity exists to develop exportable technologies at the same time that basic B.C. timber supply problems are addressed in a more operational manner.

In a multi-use forest under intensive management, many recreation and EPA areas can be rotated over time. GIS systems enable the effective implementation and monitoring of a multi-dimension land use plan.

The economic issues of improving resource information systems can be expressed quite simply at the strategic level - the information is critical to effective management of B.C.'s most valuable asset, the public forests. The stability of forest-dependent communities, and of the Provincial economy is at stake.

## IMPROVED UTILIZATION

Several products can use the "marginal" wood as defined in this study, under current conditions. Several other products would be feasible under one or more incentive schemes. These conditions are specified in detail in Sections 3 and 4.

At the same time, forces are already in motion in the B.C. pulp and paper industry which will most likely lead to higher fibre prices in the 1990's. What is "marginal" today may well be in the industry mainstream by 1995.

Regional differences (both in forest resources and established industries) make it essential to consider new industry location(s) carefully.

In addition to better information on resources and technologies, an integrated policy framework will be needed to make the necessary public forest allocation, pricing, renewal and social decisions. Policies in taxation, energy, trade, and research can be as important as forest policies. Social and environmental concerns must also be considered.

Within this broader framework, the objective of the study has been to define a few of the most likely forest industry operations capable of utilizing marginal stands and marginal materials from sawlog stands. Both fully costed operations and operations receiving selected incentives (reduced property taxes, reduced power rates, and wage reductions) have been analyzed. Table 37 provides a summary of the results, for smallwood, decadent wood and hardwoods, in the relevant regions.

These case studies were conducted at what is normally termed the "pre-feasibility" level, where known industry cost and revenue relationships are used to screen potential investments before detailed feasibility study and design engineering is launched at a much more intensive level.

There are examples which appear favorable for more detailed study in each of the three "marginal" resource types.

. Utilization of smallwood (sound)

- sawmills; all regions
- sliced veneer; South Coast, Cariboo, Kamloops/Nelson
- wood-based panels; most regions, minor incentive in some cases

. utilization of overmature wood (portions unsound)

- sawmills; South and Mid Coast, Prince Rupert (I) and Kamloops/Nelson
- sliced veneer; South Coast, Kamloops/Nelson (incentives)
- Medium Density Fibreboard or Particleboard; Prince Rupert (I), Kamloops/Nelson, particularly with incentives
- pulpwood; South Coast, Prince Rupert (I), Kamloops/Nelson, particularly with incentives

. utilization of hardwoods

- sawmills; South Coast, Prince Rupert (I), Prince George
- OSB panels; Prince Rupert (I), Prince George, particularly with incentives
- pulpwood;South Coast, Prince George, particularly with incentives

Table 37. Feasibility Summary of Utilization Opportunities by Product, Type of Wood and Region

| PRODUCT TYPE OF WOOD | REGION | FEASIBILITY RATING[1] |
|---|---|---|
| **MEDIUM DENSITY FIBREBOARD** | | |
| DECADENT | Kamloops or Nelson | Possible |
| | Prince Rupert (I) | Possible |
| | North Coast | Unlikely |
| | Mid Coast | Unlikely |
| | South Coast | Unlikely |
| SMALLWOOD | Cariboo | Likely |
| | Prince George | Possible |
| | Prince Rupert (I) | Possible |
| | Mid Coast | Possible |
| | South Coast | Possible |
| **ORIENTED STRANDBOARD (WAFERBOARD)** | | |
| DECADENT | Kamloops or Nelson | Unlikely |
| ASPEN | Prince George | Possible |
| | Prince Rupert (I) | Possible |
| **PARTICLEBOARD** | | |
| DECADENT | Kamloops or Nelson | Possible |
| | Prince Rupert (I) | Possible |
| | South Coast | Unlikely |
| SMALLWOOD | Cariboo | Likely |
| | Prince George | Possible |
| | Prince Rupert (I) | Possible |
| | Mid Coast | Unlikely |
| | South Coast | Possible |
| **SAWN HARDWOOD** | | |
| ASPEN | Prince George | Feasible |
| | Prince Rupert (I) | Feasible |
| ALDER | South Coast | Likely |

| PRODUCT TYPE OF WOOD | REGION | FEASIBILITY RATING[1] |
|---|---|---|
| **SLICED VENEER** | | |
| KNOTTY PINE | Kamloops | Likely |
| | Cariboo | Likely |
| KNOTTY CEDAR | Kamloops | Likely |
| | Nelson | Likely |
| HEM-FIR-CYP | South Coast | Likely |
| CLEAR HEMLOCK | South Coast | Likely |
| **SMALL LOG SAWMILLING** | | |
| SMALLWOOD | Kamloops | Feasible |
| | Nelson | Feasible |
| | Cariboo | Feasible |
| | Prince George | Feasible |
| | Prince Rupert (I) | Feasible |
| **PULPWOOD CHIPPING PLANT** | | |
| DECADENT | Kamloops or Nelson | Possible |
| | Prince Rupert (I) | Possible |
| | North Coast | Unlikely |
| | Mid Coast | Unlikely |
| | South Coast | Possible |
| SMALLWOOD | Kamloops | Possible |
| | Nelson | Possible |
| | Cariboo | Possible |
| | Prince George | Unlikely |
| | Prince Rupert (I) | Unlikely |
| | Mid Coast | Unlikely |
| | South Coast | Possible |
| ALDER | South Coast | Possible |
| ASPEN | Prince George | Possible |
| **SAWING DECADENT HEMLOCK** | | |
| DECADENT | Kamloops and Nelson | Feasible |
| | Prince Rupert (I) | Feasible |
| | North Coast | Unlikely |
| | Mid Coast | Possible |
| | South Coast | Likely |

Footnote to Table

1. Rating Criteria

| | |
|---|---|
| Feasible | Feasible at current product price with maximum wood, labour and utilities costs |
| Likely | Feasible if minor increase in product price or minor decrease in cost |
| Possible | Need product price increase, lower or incentive costs, or moderate combination of both |
| Unlikely | Need large product price increase, large cost reductions, or significant combination of both |

It is of interest that the expectation for small, rot-free pieces is largely for increased utilization without any extra incentives. This follows the historic industry evolution.

The outlook for hardwoods is similar, in that many economic operations are underway and proposed in the northeast of B.C. and the northwest of Alberta, to utilize the extensive aspen forests of the area. On the coast, the outlook for alder, while slightly more uncertain, looks promising particularly if the export demand for chips continues to increase. The current situation in Washington and Oregon, where the total alder resource is currently under economic harvest and heavily supported by export demand, seems likely to be a precursor of events here.

There seems to be little need for special policy interventions to foster smallwood or hardwood utilization at present. Normal forestry and current policies should work, although some "fine-tuning" might be necessary.

The principal remaining "problem-area" or "opportunity" for policy intervention, is in developing economic means of harvest and utilization for the decadent stands in B.C. (principally Coast and Kamloops/Nelson). Similarly, but to a lesser degree, a problem exists in utilizing the logging residuals of sawlog stands on the Coast.

## INTEGRATED STRATEGY

This section will add some consideration of other variables to the analysis, in seeking recommendations for detailed actions to further economic utilization of currently "marginal" forest resources in the 1990's.

It may be noted for example, that the principal criterion for screening used here is net return to the operator, per unit of input volume. This is relatively easy to calculate, and provides a common economic indicator. The whole data set is relatively easy to re-form into a calculation of return-on-investment, if desired.

Other elements will be of interest to a public decision maker, given the prospect of basic economic viability. For example, the potential for additional value-added in manufacturing, based on each type of operation, will be different.

Among the wood-based panels tested, medium density fibreboard (MDF) production would generate significant new opportunities for manufacture of furniture and kitchen components in the Province. The fine surface properties of the board are ideal for modern coatings and finishes. The alternative panels (particleboard and OSB/waferboard) are generally used in construction and other less finished applications.

Similarly, the sliced veneer and hardwood sawmill operations provide potential inputs for other industries with high additional value-added in the local economy. Further manufacture at or near these operations should be considered and investigated.

The volume used (scale) in each operation will be of interest within the tightening timber allocation system in each region. Sliced veneer can use less volume per economic-sized mill than panel mills. Pulp mills are already in place or will be constructed mainly to use other materials than the ones defined here (hardwoods are an important exception). However the "marginal" resources can be used to supplement fibre supplies, and substitute for other materials which could develop higher value uses than pulp furnish over time (i.e. small sawlogs on the coast).

In general, combinations of different operations will provide the best over-all utilization of resources, as in the past. An element of diversification is important, as are links between operations in the forestry sector. Wood product operations which are profitable (e.g. smallwood sawmills, sliced veneer mills) will generate chips as residues for the local fibre market(s).

In the study the effect of special measures or incentives to induce improved utilization of marginal forest resources was shown in the summary tables. Variation in wood costs, but particularly labour rates and utilities and taxes show production viability as these cost factors are decreased. If any special measures or incentives were to be considered to induce improved utilization, a relatively complete economic scenario should be constructed in addition to any profit/loss analysis. This would ensure that the special measures were in fact necessary, that the expected benefits would be achieved, and that undesirable economic and environmental side-effects would not occur.

Special measures of the type described have already been applied in B.C. forest industry operations. They include "cooperative" labour rates, discounted utility rates to induce production location in areas having surplus power or gas and incentive tax rates (or holiday) by municipalities seeking an expanded longer term tax base.

These measures do not exhaust the possibilities for special measures. Other measures used in the past in Canada include special loan terms/guarantees or even capital infusions by government. For a current example, the B.C. Coast Gas Pipeline could be cited. In order to achieve expected long term community and industry development benefits, public capital resources will be used to initiate construction of a basically privately-owned/operated facility.

However, the cases simulated in the study should provide an adequate range of expected impacts of special measures to enhance the viability of new marginal-wood-using industries in each region. This will involve careful integration with other forest sector policies.

Refinements of timber supply estimates, and monitoring-feedback systems will be essential to a new utilization strategy for the long run. Without a firm base in resource definitions and projections, the utilization-effect can slip away in practice. This could leave increased industry capacity bidding for the same (sawlog) resource, and make "falldowns" more likely.

The expected royalty/stumpage for marginal forest materials would be expected to remain at its present order of magnitude (25 to 50 cents per m3) for some time.

Modifications to raw material export (including chips) controls might be considered for particular materials from marginal stands, to enhance the viability of the total operation.

Resolution of problems with the present AAC and any problems foreseen with closer utilization, will have to be actively pursued with agencies and publics concerned with the environment.

Aspects of energy-pricing policy will have to be pursued with B.C. Hydro and relevant gas utilities. Hydro is responsible for pricing/purchases of cogenerated electricity (e.g. from wood-waste burning facilities) as well as for pricing/sales of power to new plants.

Finally, employment and wage policies will have to be explored with public labour agencies, and with relevant unions. One of the most significant measures explored is that of a wage rate slightly below the suggested forest industry norm. These rates selected for simulation purposes come from existing co-op or worker-owned operations in the B.C. forestry sector, and a few non-union operations. Although below IWA or Pulp Union scales, they are significant in terms of wage rates paid in other sectors of communities in B.C.

In spite of the complexity of the forestry, social and environmental issues surrounding enhanced utilization of B.C. forest resources, the time is approaching when real economic opportunities will be foregone if public action is paralyzed in this field. Some concrete recommendations for action which should accelerate economic processes already underway in improved forest utilization follow.

## 8. RECOMMENDATIONS

Within the strategy outlined above, an ordered sequence of a few specific actions can be recommended to pursue the objective of improved utilization.

### 1. Research Support

New research, including more short term or applied research (problem solving) will be necessary to support improved forest resource utilization. In the case of decadent stands an increased emphasis should be placed on the maintenance and care of site productivity and on the establishment and tending of a new healthy young forest. Similarly, increased attention should be given to lands currently scheduled for harvest in terms of an increased effort to improve productivity and future benefits. In simple terms, harvesting more hectares must give way to a serious consideration for growing greater volumes in a given time period on those accessible hectares allocated to production forestry.

Considering the above, in general, the following areas of research are believed to need greater attention. They should be considered within a total framework of forest research, but at an increased level of priority. This research would best be conducted by Forestry Canada or the Ministry of Forests, with the latter emphasizing shorter term operational needs:

- identification of integrated use opportunities and conflicts with particular emphasis on planning information (given an increased use of "Geographic Information Systems"). In addition to water, wildlife and recreation interactions with timber production, access to the forest and roading timber sheds should have an increased link to strategy development.

- Increased research on soils and hydrology, both for production forests and integrated use forests. It should consider soil disturbance, compaction and erosion under conditions anticipated for future use(s). Where appropriate roading and road standards should also be considered.

- Increased attention to silviculture prescriptions based not only on ecology and species but also on objectives concerning use and timber production for specific areas. This should include an economics of silviculture component as any increase in forest management levels and/or complexity is highly likely to lead to a situation where choices are necessary. Regardless of funding, some treatments or prescriptions will provide greater benefits at lower cost than others.

- The whole area of documenting and projecting yields from second growth forests and new management regimes needs to be addressed. Information from the past concerning natural standards that received a low level of management will not provide a firm basis for projecting the quality and yields of the new forest(s). For the new forest the effect of tree improvement, artificial regeneration, stocking control and fertilization are variables that must now be considered individually and in concert.

## 2. Hardwood Resource Inventories

As outlined in the strategy, smallwood and hardwood resources are already entering the economic spectrum of the B.C. forestry sector. Little new action is therefore deemed necessary at this time.

However, there is one important difference between the two sets of resources in current resource inventories - smallwood coniferous resources are generally adequately defined for economic/policy studies; hardwood resources most often are not so well defined.

The problem is different for alder on the Coast and aspen in the Interior, but the net effect is the same - the resource has been ignored or inadequately treated in most inventories done more than five years ago. The reason is clear - these species were regarded as non-commercial until this decade.

Therefore, the recommendation is made that a special forest inventory effort be mounted to update information useful in planning economic utilization of this "new" resource. This effort should be accommodated under MOF jurisdiction but could have a significant private component.

## 3. Phased Approached to Decadent Resource Utilization

- Refined TSA Case Study

  For a selected TSA, or conceivably "log-shed" containing more than one TSA, which contains a significant overmature or decadent resource, the recommendation is made that a new more detailed approach to timber supply analysis be developed (using existing data and models).

  The analysis would focus on total asset management concepts for the TSA, rather than on concepts which merely react to current demands and provide crisis management.

  Economic operability definitions would be based on technology and stand development forecasts, as well as on current inventory stands. Close attention would be paid to current definitions of "operable stands", "operable areas" and access networks. GIS systems would be used to analyze and inventory these definitions.

  Ideally, the analysis would include detailed (GIS) definitions of environment protection areas, including their objectives, and operational roles in achieving these objectives. More detailed species-specific management prescriptions would be attempted wherever possible.

  The AAC and LRSY projections so derived would not have immediate policy impacts, but would be considered as "pilot-studies for policy". To become "hardened" into policy, further works would be expected, as follows.

. Improved Inventory of Decadent Stands

Within the selected test area, a detailed forest inventory study for overmature and decadent stands would be designed and executed. The problem with decadent stands is not just their physical properties, but also the high degree of uncertainty (variability) in stand properties. Extra volume and decay samples are required to establish the real economic status of such stands.

Improved physical definitions would permit continuous updating of economic definitions of "operability" or even "salvage" of such stands over time.

Upon completion of the special inventory study the TSA supply analysis could be re-run using different management assumptions for various overmature and decadent parts of the forest inventory, based on the new operational data.

This activity would be within the Provincial jurisdiction. Assistance might be provided under the Regional Development objective, since the purpose is to define "new" resource potentials in the areas of current high unemployment (e.g. Nelson area).

If the results of such a study warranted it, this would lead directly to the next step.

. Pilot Utilization Trials

The most expensive phase would be the establishment of actual costs and benefits from major trials of new utilization scenarios. Defined stands would have to be felled and extracted, with materials sent to various appropriate existing facilities (e.g. pulpmills, panel mills, wood product mills) for scale testing.

Industry participation could be expected at this stage, together with Provincial and Federal resources for regional development.

Results of these pilot trials could be developed into detailed investment scenarios for particular plants as warranted, and for detailed forest asset management scenarios within the TSA analysis.

4. Specific Technology Development

All marginal forest materials have in common the problem that they contain higher proportions of undesirable woody materials (in addition to usable materials) than do currently economic materials.

Some of the most significant economic losses occur when these undesirable fractions get into normal mill flows and processes (e.g. knotwood, bark, discolored wood, various degrees of rotten wood).

Therefore, some applied research development work would be justified in:

- removing undesirable fractions from chipped materials (FORINTEK/PPRIC)
- Removing undesirable fractions in the woods; improving residuals in the woods definitions (FERIC)
- innovative approaches to bark removal at any stage

This work could be funded on a combined or joint federal-provincial-industry basis.

Many technologies are in place and others are known to have potential application. The consultants feel that some resources applied specifically to these problems could be valuable on a wide frontier of improving utilization in B.C. and elsewhere in Canada.

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CAPITAL COST (EST.) PARTICLEBOARD TABLE 89173

Assumptions:

| | |
|---|---|
| Mech Installation as % of Equipment | 35 |
| Electrical as $/Connected Horsepower | 350 |
| Gas Consumption MMBTU/hr. | 100 |
| Electrical Consumption | |
| Operating Days Days/yr | 300 |

| Item | "Normal" Elect. H.P. | "Normal" Cost '000 $ | "Decadent" Elect. H.P. | "Decadent" Cost '000 $ |
|---|---|---|---|---|
| Land Value | | Not incl. | | Not incl. |
| Site Preparation | | 250 | | 250 |
| Buildings & Foundations | 200 | 2500 | 200 | 2500 |
| Raw Mat'l Handling | 150 | 400 | 200 | 600 |
| Debarking | 600 | 2500 | 900 | 4500 |
| Chipping | 900 | 450 | 900 | 450 |
| Flaking & Milling | 1900 | 1425 | 1900 | 1425 |
| Drying | 500 | 2440 | 500 | 2440 |
| Resin/Wax System | 130 | 550 | 130 | 550 |
| Storage & Metering | 150 | 600 | 150 | 600 |
| Forming Line | 150 | 3680 | 150 | 3680 |
| Pressing | 425 | 4800 | 425 | 4800 |
| Panel Sizing | 130 | 625 | 130 | 625 |
| Sanding | 300 | 480 | 300 | 480 |
| Storage & Shipping | 50 | 125 | 50 | 125 |
| Maintenance | 70 | 300 | 70 | 300 |
| Compressed Air | 300 | 250 | 300 | 250 |
| Fire Protection | 0 | 800 | 0 | 800 |
| Water System | 50 | 150 | 50 | 150 |
| Sewage System | 30 | 250 | 30 | 250 |
| Wasre Burner | 100 | 300 | 100 | 300 |
| Mobile Equipment | 0 | 750 | 0 | 750 |
| Freight | 0 | 1000 | 0 | 1000 |
| Sub. Tot. | 6135 | 23625 | 6485 | 25825 |
| Mechanical Installation | | 7306 | | 8076 |
| Electrical Installation | | 2147 | | 2270 |
| Sub. Tot. | | 33079 | | 36171 |
| Engineering & Project Management | | 1810 | | 1986 |
| Sub. Tot. | | 34889 | | 38157 |
| Contingency | | 3489 | | 3816 |
| TOTAL EST. COST | | 38377 | | 41973 |

SOURCE: CONSULTANT FILES

RAW MATERIAL BALANCE PARTICLEBOARD 89173

| Assumptions: | "Normal" | "Decadent" |
|---|---|---|
| Panel Den. @ 5% m.c.Kg/M3 | 700 | 710 |
| Resin content % | 8 | 8.5 |
| Wax Content % | 0.25 | 0.25 |
| Raw Mat. Den. (OD) Kg/M3 | 440 | 420 |
| Raw Mat. Den. (Gr.) Kg/M3 | 880 | 933 |
| Raw Mat. M.C. % | 50 | 55 |
| Sanding Loss % | 4 | 4 |
| Trim Losses % | 7.4 | 7.4 |
| Fines Loss % | 4 | 5 |
| Milling Loss % | 1 | 1.5 |
| Screen Loss % | 0 | 0 |
| M.C. Finished Board % | 5 | 5 |

ANNUAL RAW MATERIAL CONSUMPTION- 300 DAY YEAR

| | "Normal" | | "Decadent" | |
|---|---|---|---|---|
| | TPA | M3/Annum SWE | TPA | M3/Annum SWE |
| Wood Input | 218642 | 248457 | 249110 | 266904 |
| Less M.C. | 109321 | | 137011 | |
| | 109321 | | 112100 | |
| Less Screen Losses | 0 | | 0 | |
| | 109321 | | 112100 | |
| Less Milling Loss | 1093 | | 1681 | |
| | 108228 | | 110418 | |
| Plus Resin | 8658 | | 9386 | |
| | 116886 | | 119804 | |
| Plus Wax | 292 | | 300 | |
| | 117178 | | 120103 | |
| Less Fines Losses | 4687 | | 6005 | |
| | 112491 | | 114098 | |
| Less Trim Losses | 8324 | | 8443 | |
| | 104167 | | 105655 | |
| Less Sanding Losses | 4167 | | 4226 | |
| | 100000 | | 101429 | |
| Plus Moisture | 5000 | | 5071 | |
| NET BOARD OUTPUT (Tonnes & M3) | 105000 | 150000 | 106500 | 150000 |

SOURCE: CONSULTANT FILES

ANNUAL OPERATING COST PARTICLEBOARD 89173

ANNUAL CAPACITY (M3/YR.) 150000

| Assumptions: Item | Rate | Item | Rate |
|---|---|---|---|
| Wood cost $/M3 | 22 | Elect. cost $/KWH | 0.05 |
| Labor Rate $/hr | 18.5 | Gas Cost $/Therm | 0.04 |
| Fringe Benefits % | 38 | Ship. suppl. $/M3 | 1.75 |
| No. of H'rly Emp | 120 | Salaries $/yr. | 750000 |
| Resin Cost $/Kg | 0.61 | Insurance % Value | 1.5 |
| Wax Cost $/Kg | 0.48 | Supplies $/yr | 150000 |
| Op. Supplies $/M3 | 3.5 | Cons. & Legal $/yr | 60000 |
| Mtce. Supp. $/M3 | 3.5 | Travel & Ent. $/yr | 75000 |
| Lubricants $/M3 | 0.5 | Depreciation %/yr | 10 |
| Boiler Chems $/yr | 0 | Taxes % Value | 1.25 |

| Item | "Normal" '000 $/yr | "Normal" '$/M3 | "Decadent" '000/yr | "Decadent" $/M3 |
|---|---|---|---|---|
| VARIABLE COSTS | | | | |
| Raw Material (Wood) | 5466 | 36.44 | 5872 | 39.15 |
| Production Labour | 5882 | 39.21 | 5882 | 39.21 |
| Fuel-Mobile Equipt. | 75 | 0.50 | 75 | 0.50 |
| Chemicals - Resin | 5282 | 35.21 | 5725 | 38.17 |
| Chemicals - Wax | 140 | 0.94 | 144 | 0.96 |
| Chemicals - Boiler | 0 | 0.00 | 0 | 0.00 |
| Operating Supplies | 525 | 3.50 | 525 | 3.50 |
| Maintenance Supplies | 525 | 3.50 | 525 | 3.50 |
| Lubricants | 75 | 0.50 | 75 | 0.50 |
| Shipping Supplies | 263 | 1.75 | 263 | 1.75 |
| Natural gas | 1728 | 11.52 | 1728 | 11.52 |
| Electricity | 897 | 5.98 | 948 | 6.32 |
| Sub Total | 20858 | 139.05 | 21762 | 145.08 |
| FIXED COSTS | | | | |
| Salaries | 750 | 5.00 | 750 | 5.00 |
| Insurance | 576 | 3.84 | 630 | 4.20 |
| Supplies | 150 | 1.00 | 150 | 1.00 |
| Cons. & Legal | 60 | 0.40 | 60 | 0.40 |
| Travel & Ent. | 75 | 0.50 | 75 | 0.50 |
| Depreciation | 3838 | 25.58 | 4197 | 27.98 |
| Taxes (property) | 480 | 3.20 | 525 | 3.50 |
| Sub Total | 5928 | 39.52 | 6387 | 42.58 |
| COST OF SALES | 26786 | 178.57 | 28148 | 187.65 |
| REVENUE | 26835 | 178.90 | 26835 | 178.90 |
| VARIABLE MARGIN | 49 | 0.33 | -1313 | -8.75 |

SOURCE: CONSULTANT FILES

## APPENDIX 2 Explanation of Terms Used in the Manufacturing Summary Tables

**Type of Wood**

Smallwood refers to small marginal sawlogs and pulpwood for the species mix currently harvested in the Region.

Decadent refers to decadent old growth hemlock or cedar. Where pulp chips were included as a by-product, the species would be hemlock.

Hardwood cases are specified aspen or alder.

Veneer cases are specified as to species or mix.

**Wood Cost**

Refers to delivered wood cost based largely on contract logging. Where two costs are shown (with the exception of veneer logs) the lower cost is the estimated value of smaller and/or poor quality wood separated from the average. In the case of veneer logs, they would be selected (sorted) from the average at a higher cost. Minimal stumpage was assumed for small marginal logs and decadent wood.

**Labour Rate**

Three general rates were considered. $18.50/hour was chosen to reflect the current union rate. Overheads and fringe benefits were taken at 38%. A non-union and/or co-operative rate of $14.00/hour with overheads and fringe benefits at 31% was considered second. A subsidized rate of $12.00/hour with 22% for overheads and fringe benefits was considered last.

**Utilities & Taxes**

| | | |
|---|---|---|
| Normal Rate: | Electricity | $0.05 per kwh |
| | Gas | $0.04 per therm |
| | Property taxes | 1.25% of plant value |
| Incentive Rate: | Electricity | $0.03 per kwh |
| | Gas | $0.033 per therm |
| | Property taxes | 0.90% of plant value |

**Expected Net Selling Value**

The net return at the plant from sales per solid wood equivalent sold.

**Net Revenue**

The net return at the plant from sales per solid wood equivalent sold, less the fixed and variable costs of manufacture.

**Annual Revenue**

The net revenue per solid wood equivalent times the net plant annual output operating at capacity.

Appendix 3

**UTILIZATION STANDARDS**
Coast

TIM 011 1

PURPOSE:

The purpose of this Policy is to establish minimum required utilization standards for timber harvesting operations on the Coast.

SCOPE OF APPLICATION:

This Policy is applicable to timber harvesting operations authorized under the FOREST ACT on the Coast of the province. This policy is effective from January 1, 1989.

DEFINITIONS:

Coast: that part of the Province where log-based appraisal is used, predominantly the geographic area of the province west of the Cascade Mountains.

Allowable Annual Cut (AAC): the rate of harvest determined by the Chief Forester for Timber Supply Areas (TSAs) and Tree Farm Licences (TFLs), and by the District Manager for Woodlot Licences (WLs), and the rate of harvest specified in a licence or in a management and working plan.

Waste: the volume of timber which should have been removed from the logged area by the licensee based on the minimum cutting and utilization standards stated in the cutting authority but has been left on the harvested area.

Unavoidable Waste: that component of the waste which cannot be removed with a reasonable effort because of physical impediments and safety reasons.

Avoidable Waste: the waste minus the unavoidable waste.

Residue: the volume of timber that is below the required standard of utilization but is part of the AAC for cut control purposes (includes grade Y logs from live trees).

Residue and Waste Reporting Unit: the area for which the waste is measured and reported. It may be either a cut block or licence, or parts of a licence.

Coast Old Growth: a stand of timber which has an average age of greater than 120 years.

Coast Second Growth: a stand of timber which has an average age of 120 years or less.

Minimum Utilization Standards: the standards of timber cutting and log utilization specified in the cutting authority.

Log Grade: those log grades that are defined in the Scaling Regulation.

POLICY STATEMENT:

It is the Policy of the Ministry that minimum cutting and utilization standards shall be specified in all documents authorizing timber harvesting.

CONDITIONS:

1. Except for deciduous species, salvage logging, and selection cutting, the minimum cutting standards will be as follows:

| | Old Growth | Second Growth |
|---|---|---|
| - maximum stump height, cm * | 30.0 | 30.0 |
| - minimum top diameter inside bark, cm | 15.0 | 10.0 |
| - minimum slab thickness, Cedar only | 15.0 | |
| - log length, m | 3.0 | 3.0 |

2. Cutting specifications for deciduous species, salvage logging and selection cutting will be set by the District Manager on a site-specific basis.

3. All coniferous logs except logs designated Grade Y and Grade Z must be utilized.

4. The cutting and utilization standards described in Nos. 1, 2 and 3 above will be assumed on cruise-based cutting authorities, but residue and waste measurements will not be required. Where the standard of utilization expected to be practiced is of major concern, cruise-based cutting authorities will not be issued.

* measured on the side adjacent to the highest ground.

5. Scale-based cutting authorities under Tree Farm Licences (TFLs), Timber Licences (TLs) outside TFLs, Forest Licences (FLs) and Timber Sale Licences (TSLs)(Major) with an Allowable Annual Cut (AAC) over 10 000 $m^3$ will require the holder to have the residue and waste measured in accordance with the "Vancouver Region Depletion Survey Manual" during 1989, and the "Forest Service Residue and Waste Measurement Manual, "from January 1, 1990. Licensees will have the results reported to the Forest Service within 60 operative days (when field work is reasonably possible) of completion of logging, unless the time limit is extended by the District Manager, under the seal of an R.P.F. Licence holders will be encouraged to have the residue and waste measurement and reporting done by an independent party. This work will be done at the expense of the Licensee.

6. All residue and waste volumes will be added to the scaled volume for cut control purposes, and will be charged to the AAC for the licence.

7. All scale-based cutting authorities will specify that all avoidable waste will be billed monetarily at stumpage or royalty rates, described under conditions 8, 9, 10, 12 and 13 below. Volumes billed will be determined from sample plot measurements made within all cut blocks logged during the calendar year (as described in Condition 8. below) or from a sampling of cut blocks logged during the calendar year (as described in Condition 9. below), in which case the average waste volume determined will apply to all cut blocks logged in the identified reporting unit for the calendar year.

8. Licensees, at their option, may choose a cut block as the residue and waste reporting unit, and have the residue and waste measured for every cut block of their licence. Billing for avoidable waste will immediately follow reporting, and will be at the average billed stumpage (or royalty) rates over the preceding 12-month period for the timber mark.

9. Subject to condition 10. below, licensees, at their option, may choose a Licence or part of a Licence as the residue and waste reporting unit, and if so, will have the average residue and waste ($m^3$/ha) measured for the unit(s) applied to all cut blocks harvested within the reporting unit during the calendar year. Billing for avoidable waste will be by timber mark at the average billed stumpage (or royalty) rate over the preceding 12-month period for the timber mark.

10. Notwithstanding condition 9. above, the District Manager may require that the waste be measured and reported to him for one or more cut blocks, if and where he considers the waste excessive. The avoidable waste will be billed at the average stumpage (or royalty) rates over the preceding 12-month period for the timber mark. Such cut block(s) will be excluded from the determination of, and billing for the average avoidable waste for the relevant licence.

11. The option of Condition 8. or 9. above, elected by the Licensee, has to be formally approved by the District Manager.

12. For scale-based licences or cutting authorities under the Small Business Forest Enterprise Program, the licensor will have the residue and waste measured. Billing for the avoidable waste will be at the average stumpage rate over the preceding 12-month period for the licence.

13. For scale-based cutting authorities under Woodlot Licences, the licensor may require the licensee to have the residue and waste measured and the results reported to the Forest Service, or the licensor may have the residue and waste measured. Billing for avoidable waste will be at the average stumpage rate over the preceding 12-month period for the licence.

14. Subject to Condition 15., grade Y logs will be considered as part of the cut for cut control and AAC purposes, and where utilized, will have a stumpage charge as defined in the appraisal manual, (currently $\$.25/m^3$) or royalty, as prescribed in the Regulation (currently $\$.25/m^3$). There will be no charge for Grade Y logs which are not utilized. Grade Z logs will not be considered as part of the cut, and will not bear stumpage charges.

15. For the period January 1, 1989 to December 31, 1990, grade Y logs from dead trees left on the ground will not be considered part of the AAC. This condition of policy will be reviewed on or before December 31, 1990.

16. The District Manager may require that Y grade logs of Cedar and Yellow Cedar be yarded or skidded to the landings, where, in his opinion, a demand for such logs exists.

RESPONSIBILITIES:

Chief Forester:

- to determine the AAC for TSAs and TFLs;
- to ensure that the applicable minimum utilization standards are used in the determination of AACs for TSAs and TFLs.

Director, Timber Harvesting Branch:

- to monitor the administration of this Policy;
- to recommend changes to the policy when considered desirable or necessary;
- to provide technical expertise to the Regions and Districts, as required.

RESPONSIBILITIES: (Cont'd)

Director, Valuation Branch:

- to develop standards and procedures for estimating the volume of waste and residue timber.

Regional Manager:

- to ensure that Districts adhere to this Policy;
- to recommend modified utilization standards to the Executive through the Director, Timber Harvesting Branch, when considered necessary; and
- to implement Section 56 of the FOREST ACT where required.

District Manager:

- to determine the AAC for WLs;
- to implement and administer this Policy;
- to ensure that the minimum utilization standards are used in the determination of the AAC for a WL;
- to include a clause in cutting permits or timber sale licences that will allow a billing for waste in accordance with 8, 9, 10, 12 and 13 above; and
- to initiate waste billing.

REFERENCES:

FOREST ACT, Part 2, Section 6, 7 and Part 4

Scaling Regulation 563/78 and all amendments.